DIT UNIVERSITY
Dehradun

Detailed Course Structure & Syllabus

of

B.Sc (Hons) Physics

(Fully Flexible Choice Based Credit System)

Approved by the Academic Council at its 17th Meeting held on 24.03.2021

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

Introduction

The Ministry of Human Resource Development (MHRD), Govt. of India, has initiated development of a New Education Policy (NEP) to bring out comprehensive reforms in the Indian education system.

The University Grants Commission (UGC) has subsequently initiated several steps to foster academic excellence through introduction of paradigm shift in learning and teaching pedagogy, innovation and improvement in course curricula, examination and education system.

While a majority of education institutions have started following the semester-based system of education, it has been observed that this new system is still producing graduates who lack knowledge, values, skills and are not job ready professional. The reason for this lacking could be attributed to the rigidity of our program structures and lack of flexibility to have choices among core subject education, liberal arts, ability enhancement, skill development, etc., that is fundamental to overall development and employability of these graduates.

To make this possible, a fully flexible choice-based credit system (FFCBCS), a well-established internationally known system, is proposed. This fully flexible choice-based credit system allows students the flexibility to learn at their own pace, and register for both core subjects and a variety of courses from other areas, leading to holistic development of an individual. The FFCBCS will facilitate us to bench mark our programs with best international liberal arts based academic programs.

Advantages of the FFCBCS structure:

- Shift in focus from the teacher-centric to student-centric education. Student can curve out their program structure by choosing minimum number of credits from well-defined baskets.
- Student may undertake as many credits as they can cope with.
- FFCBCS allows students to choose courses from various baskets of inter-disciplinary, intra-disciplinary, skill oriented, ability enhancing, and from other disciplines.

Features unique to DIT University FFCBCS structure:

1. A minimum of 142-146 credits has to be earned by a student to be eligible for an Under Graduate Honor degree in Sciences. Each department will decide their total credits for each program, and it can vary across disciplines.

2. Courses are categorized into 9 baskets, and a student will have the option to choose courses in most baskets and earn ***minimum number of credits*** required in each basket for the award of his/her degree. For each basket, the departments have the flexibility to identify course(s) which will be a core requirement for their program.

3. In certain disciplines, students may choose a ***Specialization*** by earning 18 credits of Discipline Specific Elective courses towards a particular area of that discipline (intra-disciplinary). In addition to this, brighter students will have the option to receive (a) a ***Certificate*** by earning *additional* 9 credits towards a particular area either inside or outside their discipline, or (b) ***Minor*** by earning additional 18 credits towards a particular area outside their discipline. Certificates and Minors can be earned through either University courses, or with MOOCs from providers as identified by the University. Each department will design the structures and eligibility conditions for registration to its certificates or minor program, which may be reviewed annually, to keep the ***Certificates*** and ***Minors*** contemporary and relevant to latest changes.

4. An Academic Advisory Committee may be formed comprising all HoDs/ Programme Coordinator and one representative each from respective departments. Academic Advisory Committee will meet at the end of every semester after the completion of Board of Examination meeting to discuss and finalize course offerings by respective departments in the upcoming semester. Academic Advisory Committee will be chaired by the Dean Academic Affairs/ Deans of respective Schools/ Competent Authority.

5. To provide sufficient flexibility and room during the program for additional ***Certificates***, ***Specializations, and Minors***, 8-week summer semesters (Summer 1, Summer 2, and Summer 3) may have to run. Summer

semesters are critical for implementing a fully flexible system. Each department will decide *a priori* which courses to offer in the summer semester and get them finalized at the Academic Advisory Committee meeting.

6. Project based learning has to be incorporated as a core component of evaluation in each course, and depending on the level and type of the course, the project can be of several types - Study Oriented Project, Lab Oriented Project, Design Oriented Project, Computer Oriented Project, Projects of Organizational Aspects, Research Projects, or Entrepreneurship and Start Up Projects.

7. Courses under each basket may be updated on an annual basis.

8. Each student will be advised by a faculty advisor of his/her department for registration of courses from each basket in the beginning of semester, depending upon the availability of seats. A student advising centre may be formed where students will have access to department faculty advisers. Faculty advisers should have complete access to view individual student's academic transcript for advising purposes.

9. A student getting an F grade in a core course (departmental or otherwise) at the end of the semester will have to earn those credits by registering for the same course whenever it is offered in subsequent semesters. If the course is not a core course, the student may choose to register for any other course next semester in that basket as advised by the department faculty adviser. Additional fees for those number of credits may apply.

10. Students may opt for summer training/internships/industrial tours as advised by the department. However, these activities will not have credits.

Baskets of FFCBCS

9 baskets of courses have been identified to provide student comprehensive exposure to a large number of areas, leading to the holistic development of an individual. These baskets are as follows:

1. Language and Literature: These include courses related to English or other popular languages worldwide, communication skills, and literature. These courses are of 3 credits each.
2. Generic Elective: This basket includes courses from other disciplines of Science and Engineering like Mathematics, Chemistry and Computer Science.
3. Discipline Core: This basket includes compulsory courses in the discipline in which the student is admitted to the University. These courses are of 4-6 credits each.
4. Discipline Specific Elective: This basket provides students courses other than discipline core, and are normally in certain specialized areas. These courses are of 4 credits each.
5. Humanities and Liberal Arts: This basket includes liberal arts courses in various disciplines like psychology, management, economics, etc., and are of 3 credits each.
6. Skill Enhancement: Courses in this basket are primarily hands-on and aims to allow students acquire skills required in certain disciplines that are currently in high demand in the job market. These courses are of 2-3 credits each.
7. Ability Enhancement: These courses aim to enhance knowledge and ability of an individual in certain required areas related to national and societal interest. Courses in this basket are of 2 credits each.
8. Free Electives: Student can register for any two courses outside their department of his/her choice. These courses can also be taken from MOOCs, and a minimum of 6 credits have to be taken by a student in this basket. These courses are of 3 credits each.
9. Project: Students will do two projects in semester 5th and 6th, Minor Research Project and Major Research Project.

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Structure of the B.Sc. FFCBCS Program in Physics

Basket/Area	Min Credits To be taken	Max Credits To be taken	Credit per course	Courses
Discipline Core (DC) Core: All Elective: None	72	72	4-6	14
Discipline Specific Elective (DSE) Core: None Elective: Choose any 4 courses as per your Specialization	16	16	4	4
Generic Elective (GE) Core: None Elective: Choose any 4 courses as per your Specialization	16	20	4-5	4
Language and Literature (LL) Core: None Elective: Choose any 1 from LL course	3	3	3	1
Humanities and Liberal Arts (HL) Core: None Elective: Choose any 3 HL Courses	6	6	3	2
Skill Enhancement Courses (SEC)* Core: None Elective: Choose any courses to complete credits	9	11	2-3	4
Ability Enhancement Courses (AEC)* Core: Env. Sc, Elective: Choose any courses to complete the credits	6	6	2	3
Free Electives (FE) Core: None Elective: Choose any 2 FE courses	6	6	3	2
Project	6	6	2-4	2
Total Credits	140	146		36

** Credits in SEC and AEC courses may vary.*

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DIT University B.Sc (Hons) Physics FFCBCS Program Structure

Basket/Area	Credits
Discipline Core	72
Discipline Specific Elective	16
Generic Elective	16-20
Language and Literature	3
Humanities and Liberal Arts	6
Skill Enhancement Course	9-11
Ability Enhancement Course	6
Free Elective	6
Project	6
	140-146

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Course Baskets: University FFCBCS Baskets (other than DC/DE) for B.Sc (Hons) Physics
A * against a course means it is a core course for all B.Sc. students.

Course Baskets: B.Sc (Hons) Physics FFCBCS DC and DE Baskets

Discipline Core (72 credits)						
	Contact Hrs Credits					
	Name of Courses	**Pre-requisite Courses**	L	T	P	C
PYF106	Mathematical Physics-I	None	3	1	0	4
PYF107	Mechanics	None	3	1	4	6
PYF116	Electricity and Magnetism	PYF106	3	1	4	6
PYF117	Waves and Optics	None	3	1	4	6
PYF206	Mathematical Physics-II	PYF106	3	1	0	4
PYF207	Thermal Physics	None	3	1	4	6
PYF218	Analog Systems and Applications	None	3	1	4	6
PYF216	Mathematical Physics-III	PYF206	3	1	0	4
PYF217	Elements of Modern Physics	PYF117	3	1	4	6
PYF208	Digital Systems and Applications	PYF218	3	1	4	6
PYF306	Quantum Mechanics and Applications	PYF206, PYF217	3	1	0	4
PYF307	Solid State Physics	PYF116, PYF217	3	1	4	6
PYF326	Electromagnetic Theory	PYF116	3	1	0	4
PYF327	Statistical Mechanics	PYF207	3	1	0	4
Discipline Specific Electives (min 16-20 credits to be taken)						
	Name of Courses		L	T	P	C
PYF346	Nuclear and Particle Physics		3	1	0	4
PYF347	Experimental Techniques		3	0	2	4
PYF349	Basic Instrumentation Skills		3	0	2	4
PYF348	Physics of Devices and Instrumentation		3	0	2	4
PYF356	Computational Physics – I		3	1	0	4
PYF357	Advanced Mathematical Physics		3	1	0	4
PYF358	Medical Physics		4	0	0	4
PYF359	Physics of Semiconductor Devices		3	1	0	4
PYF366	Renewable Energy and Energy Harvesting		3	1	0	4
PYF367	Atmospheric Physics		4	0	0	4
PYF368	Introduction to Astronomy and Astrophysics		4	0	0	4
PYF369	Earth Science		4	0	0	4
PYF376	Embedded systems- Introduction to Microcontroller		3	0	2	4
PYF377	Computational Physics – II		3	1	0	4
PYF378	Nano Materials and Applications		4	0	0	4
PYF379	Introduction to Quantum Computation		4	0	0	4

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	Generic Elective (min 16-20 credits to be taken)				
	Name of Courses	L	T	P	C
CSF101	Programming for Problem Solving	3	0	2	4
CSF102	Data Structures	3	0	2	4
CSF302	Design and Analysis of Algorithms	3	0	2	4
CSF304	Artificial Intelligence	3	0	2	4
MAF108	Calculus-I	3	1	0	4
MAF117	Ordinary Differential Equations	3	1	0	4
MAF206	Computer Based Numerical Techniques	3	1	2	5
MAF216	Probability Theory and Mathematical Statistics	3	1	2	5
CHF107	Physical Chemistry-I	3	1	2	5
CHF117	Physical Chemistry-II	3	1	2	5
CHF208	Physical Chemistry-III	3	1	2	5
CHF218	Physical Chemistry IV	3	1	2	5

	Language and Literature (min 3 credits to be taken)				
Course Code	**Name of Courses**	L	T	P	C
LAF181	Professional Communication	2	0	2	3
LAF182	Indian English Literature	3	0	0	3
LAF183	English Language Teaching	3	0	0	3
LAF184	Corporate Communication and Soft Skills	2	0	2	3
	Humanities and Liberal Arts (min 6 credits to be taken)				
	Name of Courses	L	T	P	C
LAF281	Introduction to Psychology	3	0	0	3
LAF381	Positive Psychology & Living	3	0	0	3
LAF481	Application of Psychology	3	0	0	3
LAF282	Human Values	3	0	0	3
LAF283	Literature, Language & Society	3	0	0	3
LAF284	Principles of Management	3	0	0	3
LAF482	Intellectual Property Rights	3	0	0	3
LAF382	Engineering Economics	3	0	0	3
LAF287	Sustainable Development	3	0	0	3
LAF286	Youth Psychology	3	0	0	3
LAF383	Introduction to Linguistics	2	0	2	3
	Skill Enhancement Course (min 9 -11credits to be taken)				
	Name of Courses	L	T	P	C
MEF104	Workshop Practice	0	0	4	2
MAF346	Technical Writing with LATEX-I	0	0	4	2
MAF119	Introduction to MATLAB	0	0	4	2
MAF256	Aptitude and Skill Enhancement-I	3	0	0	3
MAF348	Aptitude and Skill Enhancement-II	3	0	0	3
MAF349	Aptitude and Skill Enhancement-III	3	0	0	3

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	Ability Enhancement Course (min 8 credits to be taken)				
	Name of Courses	L	T	P	C
CHF201	Environmental Science	2	0	0	2
LAF285	Indian Constitution	2	0	0	2
MEF483	Entrepreneurship and Start-ups	0	0	4	2
	Free Electives (min 6 credits to be taken)				
	Name of Courses	L	T	P	C
ECF483	Digital Image processing (ECE)	2	0	2	3
CSF381	Software Project Management	3	0	0	3
CSF345	Introduction to Data Science	3	0	0	3
CSF482	Introduction to Cyber security	3	0	0	3
MEF481	Total Quality Management	3	0	0	3
PEF381	Carbon Capture and Sequestration	3	0	0	3
PEF491	Polymer Technology	3	0	0	3
PEF492	Health, Safety and Environment in Industry	3	0	0	3
CEF382	Disaster Preparedness Planning & Management	3	0	0	3
CEF481	Environmental Management & Sustainability	3	0	0	3
CEF483	GIS	3	0	0	3
CEF484	Resource Dynamics and Economic Implications	3	0	0	3
	Project (6 credits)				
PYF308	Research Project-I	0	0	4	2
PYF328	Research Project-II	0	0	8	4

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Flow of Actions for implementing FFCBCS every semester

After release of Final Exam results, Academic Advisory Committee meets to decide & finalize course offerings in each basket

Courses are created in SAP and in MS teams with required number of seats

Registrar announces the date for Registration

Students get advised and registers for courses in the Student Advising Centre

List of students gets added in MS Teams

Class Starts

Discipline Core (72 credits)

1. Department offering the course	Physics
2. Course Code	PYF106
3. Course Title	Mathematical Physics-I
4. Credits (L:T:P:C)	3:1:0:4
5. Contact Hours (L:T:P)	3:1:0
6. Prerequisites (if any)	None
7. Course Basket	Discipline Core

COURSE SUMMARY:

The course broadly covers vector analysis of different functions, vector differentiation and integration, gradient, divergence and curl of different variables, different orthogonal curvilinear co-ordinates.

COURSE OBJECTIVE:

The emphasis of course is on applications in solving problems of interest to physicists. The students are to be examined entirely on the basis of problems, seen and unseen.

Course Pre/Co- requisite (if any) : no restricted pre-requisite

COURSE OUTCOME

1. Informally explain concept of limit of function of two variables
2. Solve ordinary second order differential equations important in the physical sciences
3. Explore the mathematical aspect of basic physical phenomenon like Divergence and Curl, which will be applied in other courses like Quantum Mechanics, Electricity and Magnetism etc.
4. Solve problems involving geometric relationships between lines and/or planes
5. Explain concept of a conservative vector field, state and apply theorems that give necessary and sufficient conditions for when a vector field is conservative, and describe applications to physics

CURRICULUM CONTENT

UNIT 1

Differentaiation. Plotting Functions. Intuitive ideas of continuous, differentiable, etc. functions and plotting of curves. Approximation: Taylor and binomial series (statements only). First Order Differential Equations and Integrating Factor.
Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration. Constrained Maximization using Lagrange Multipliers.
12 L

UNIT 2

Recapitulation of vectors: 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. 6 L

UNIT 3

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 8 L

UNIT 4

Vector Integration: Ordinary Integrals of Vectors. Multiple integrals, Jacobian. Notion of infinitesimal line, surface and volume elements. Line, surface and volume integrals of Vector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems and their applications (no rigorous proofs). 8 L

UNIT 5

Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems. 5 L

Text book [TB]:

1. Vector Analysis, Murray R. Spiegel, Seymour Lipschutz, Dennis Spellman, second edition, Tata McGraw-Hill, 2009.
2. Advanced Engineering Mathematics, D.G. Zill and W.S. Wright, 5 Ed., Jones and Bartlett Learning, 2012.

Reference books [RB]:

1. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 7th Edn., Elsevier, 2013
2. Mathematical Physics, H. K. Dass, Rama Verma, S.Chand & Company Pvt. Ltd., 2014
3. Mathematical Tools for Physics, James Nearing, Dover Publications, 2010

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1. Department offering the course	Physics
2. Course Code	PYF107
3. Course Title	Mechanics
4. Credits (L:T:P:C)	3:1:4:6
5. Contact Hours (L:T:P)	3:1:4
6. Prerequisites (if any)	None
7. Course Basket	Discipline Core

COURSE SUMMARY:

This course starts with the basic concepts of work, energy and collisions between particles. The course then covers the angular motion of bodies and moment of inertia, elasticity, fluid motion, laws of gravitation and special theory of relativity.

COURSE OBJECTIVE:

The aim of this course is to introduce students to both elementary classical mechanics and the basic ideas of Special Relativity

Course Pre/Co- requisite (if any) : Basic knowledge of vectors

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

1. To know Newton's laws of motion, potentials, conservation of energy, momentum and angular momentum, and be able to apply them to projectiles, circular motion, and gravity
2. Demonstrate rigid body and rotational dynamics using the concept of angular velocity and momentum.
3. Demonstrate an understanding of intermediate mechanics topics such as co-ordinate transformations, oscillatory motion, gravitation etc.
4. Understand the concept of non-inertial frames of reference, coriolis and centripetal accelerations and their applications
5. Understand the postulates of Special Relativity and their consequences in terms of Time dilation and length contraction, Lorentz transformations, relativistic kinematics and the relation between mass and energy

CURRICULUM CONTENT

UNIT 1: Work, Energy and Collisions

Work and Kinetic Energy Theorem. Conservative and nonconservative forces. Potential Energy. Energy diagram. Stable and unstable equilibrium. Elastic potential energy. Force as gradient of potential energy. Work & Potential energy. Work done by non-conservative forces. Law of conservation of Energy. Elastic and inelastic collisions between particles. L

UNIT 2

Angular momentum of a particle and system of particles. Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of Inertia. Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. Kinetic energy of rotation. Motion involving both translation and rotation

Elasticity: Relation between Elastic constants. Twisting torque on a Cylinder or Wire.

Fluid Motion: Kinematics of Moving Fluids: Poiseuille's Equation for Flow of a Liquid through a Capillary Tube
10 L

UNIT 3

Law of gravitation. Gravitational potential energy. Inertial and gravitational mass. Potential and field due to spherical shell and solid sphere.
Motion of a particle under a central force field. Two-body problem and its reduction to one-body problem and its solution. The energy equation and energy diagram. Kepler's Laws. Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS). Physiological effects on astronauts. 9 L

UNIT 4

Non-inertial frames and fictitious forces. Uniformly rotating frame. Laws of Physics in rotating coordinate systems. Centrifugal force. Coriolis force and its applications. Components of Velocity and Acceleration in Cylindrical and Spherical Coordinate Systems 5 L

UNIT 5

Postulates of Special Theory of Relativity. Lorentz Transformations. Simultaneity and order of events. Lorentz contraction. Time dilation. Relativistic transformation of velocity, frequency and wave number. Relativistic addition of velocities. Variation of mass with velocity. Massless Particles. Mass-energy Equivalence. Transformation of Energy and Momentum. 8 L

Text book [TB]:

1. Mechanics, D.S. Mathur, S. Chand & Co., 2012.
2. Introduction to Mechanics, D. Kleppner & R. Kolenkow, Cambridge University Press, 2017

Reference books [RB]:

1. Analytical Mechanics, G.R. Fowles and G.L. Cassiday., Cengage Learning India Pvt. Ltd., 2006
2. Introduction to Special Relativity, R. Resnick, John Wiley and Sons, 2007
3. Principles of Mechanics, J.L. Synge & B.A. Griffiths, Andesite Press, 2015

SR.NO.	LIST OF EXPERIMENTS
1	To determine the Moment of Inertia of a Flywheel
2	To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method)
3	To determine the Modulus of Rigidity of a Wire by Maxwell's needle
4	To determine the Modulus of Rigidity of a Wire by Maxwell's needle
5	To determine the elastic Constants of a wire by Searle's method
6	To determine the value of g using Bar Pendulum
7	To measure the Young's Modulus using Bending of Beam
8	To determine the value of g using Kater's Pendulum
9	To determine the frequency of AC mains using sonometer.

10	To determine the frequency of AC mains or of an electric vibrator by Melde's experiment

1. Department offering the course	Physics
2. Course Code	PYF116
3. Course Title	Electricity and Magnetism
4. Credits (L:T:P:C)	3:1:4:6
5. Contact Hours (L:T:P)	3:1:4
6. Prerequisites (if any)	Mathematical Physics I
7. Course Basket	Discipline Core

COURSE SUMMARY:
The course starts with the review of vector analysis, then it covers electrostatics and magnetostatics and different applications.

COURSE OBJECTIVE:
The aim of this course is to establish a grounding in electromagnetism in preparation for more advanced courses.

Course Pre/Co- requisite (if any) : Basic knowledge of vectors, electric and magnetic fields

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

1. To understand the basics and their use in problem solving.
2. To understand dielectric behavior in an electrostatic potential
3. To understand Biot- Savart law and Ampere's law and their use in problem solving.
4. To understand the magnetic properties and induction laws and use of induction laws in problem solving.
5. To understand the behavior of an electric circuit with ac and dc currents/ use of various theorems for problem solving.

CURRICULUM CONTENT

Unit 1: Electric Field and Electric Potential
Conservative nature of Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. Potential and Electric Field of a dipole. Electrostatic energy of system of charges. Electrostatic energy of a charged sphere. Conductors in an electrostatic Field. Surface charge and force on a conductor.

10 **L**

Unit 2: Dielectric Properties of Matter
Capacitance of a system of charged conductors. Parallel-plate capacitor. Capacitance of an isolated conductor. Electric Field in matter. Polarization, Polarization Charges. Electrical Susceptibility and Dielectric Constant. Displacement vector **D**. Relations between **E**, **P** and **D**. Gauss' Law in dielectrics. 7 **L**

Unit 3: 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 Solenoid. Properties of **B**: curl and divergence. Vector Potential. Magnetic Force on (1) point charge (2) current carrying wire. 8 **L**

Unit-4: Magnetic Properties of Matter & Electromagnetic Induction

Magnetization vector (**M).** Magnetic Intensity (**H).** Magnetic Susceptibility and permeability. Relation between **B, H, M**. Ferromagnetism. B-H curve and hysteresis.

Faraday's Law. Lenz's Law. Self Inductance and Mutual Inductance. Energy stored in a Magnetic Field. Charge Conservation and Displacement current. 8 **L**

Unit- 5: Electrical Circuits & Network theorems

AC Circuits: Kirchhoff's laws for AC circuits. Complex Reactance and Impedance. Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor

Ideal Constant-voltage and Constant-current Sources. Network Theorems: Thevenin theorem, Norton theorem, Superposition theorem, Maximum Power Transfer theorem 4 **L**

Text book [TB]:

1. Introduction to Electrodynamics, David Griffiths
2. Electricity and magnetism, K.K.Tiwari
3. Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw

Reference books [RB]:

1. Electricity and Magnetism, Edward M. Purcell, McGraw-Hill Education, 1986
2. Electricity and Magnetism, J.H.Fewkes & J.Yarwood. Vol. I, Oxford Univ. Press, 1991

SR.NO.	LIST OF EXPERIMENTS (ANY TEN)
1	Identification of various electronic components.
2	Use of multimeter for testing diodes, LEDs, transistors and measurements of resistance, capacitance, inductance, dc voltage, dc current, ac voltage, ac current and frequency of ac mains.
3	Charging and discharging of capacitor through resistance and determination of time constant.
4	To determine the specific resistance of a given wire using Carey Foster's bridge.
5	To study the variation of magnetic field with distance along the axis of a current carrying coil and determination of radius of the coil.
6	To calibrate the given voltmeter using potentiometer.
7	To calibrate the given ammeter using potentiometer.
8	To determine the band gap of a semiconductor p-n junction.
9	To determine the resistance of a sample using four probe method.
11	To verify Thevenin Theorem
12	To verify Norton Theorem
13	To verify superposition Theorem
14	To verify maximum power transfer theorem

1. Department offering the course	Physics
2. Course Code	PYF117
3. Course Title	Waves and Optics
4. Credits (L:T:P:C)	3:1:4:6
5. Contact Hours (L:T:P)	3:1:4
6. Prerequisites (if any)	None
7. Course Basket	Discipline Core

COURSE SUMMARY:

This course develops a strong background of simple harmonic motion, their superposition, wave motion, interference and diffraction.

COURSE OBJECTIVE:

This course introduces the physics of waves, oscillations and the formalism of wave behavior in the context of physical optics.

Course Pre/Co- requisite (if any) : no restricted pre-requisite

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

Having successfully completed this course the student will be able to:

1. Understand the principle of linear superposition of waves, use phasor description of waves and learn about construction of Lissajous figures
2. Develop the wave equation to find out the relationship between the speeds of propagation of waves.
3. Understand the meaning of wave impedance in case of vibrating strings, air columns and rods.
4. Learn how stationary/standing waves are produces by the superposition of incident and reflected waves in a string fixed at both ends.
5. Understand different modes of vibrations in strings, air columns and rods and learn how different harmonics are produced and also find how stringed instruments work.
6 Understand how wave nature of light can be used to explain the phenomenon of interference and diffraction.
7. Describe interference and diffraction for slits, gratings and interferometers

CURRICULUM CONTENT

Unit 1: Superposition of Collinear Harmonic oscillations

Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats). Superposition of N collinear Harmonic Oscillations with (1) equal phase differences and (2) equal frequency differences.

Superposition of two perpendicular Harmonic Oscillations: Graphical and Analytical Methods, Lissajous Figures (1:1 and 1:2) and their uses 6 **L**

Unit 2: Wave Motion

Plane and Spherical Waves, Longitudinal and Transverse Waves, Plane Progressive (Travelling) Waves, Wave Equation, Particle and Wave Velocities, Differential Equation, Pressure of a

Longitudinal Wave, Energy Transport, Intensity of Wave. Water Waves: Ripple and Gravity Waves 5 **L**

Unit 3: Superposition of Two Harmonic Waves

Vibrations of Stretched Strings, Standing (Stationary) Waves in a String: Fixed and Free Ends. Analytical Treatment. Phase and Group Velocities. Changes with respect to Position and Time. Energy of Vibrating String. Transfer of Energy. Normal Modes of Stretched Strings. Plucked and Struck Strings. Melde's Experiment. Longitudinal Standing Waves and Normal Modes. Open and Closed Pipes. Superposition of N Harmonic Waves. 7 **L**

Unit-4: Wave optics & Interference

Electromagnetic nature of light. Definition and properties of wave front. Huygens Principle. Temporal and Spatial Coherence.

Interference: Division of amplitude and wavefront. Young's double slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: Measurement of wavelength and refractive index. **Interferometer:** Michelson Interferometer-(1) Idea of form of fringes (No theory required), (2) Determination of Wavelength, (3) Wavelength Difference, (4) Refractive Index, and (5) Visibility of Fringes. Fabry-Perot interferometer. 9 **L**

Unit- 5: Diffraction

Kirchhoff's Integral Theorem, Fresnel-Kirchhoff's Integral formula and its application to rectangular slit.

Fraunhofer diffraction: Single slit. Circular aperture, Resolving Power of a telescope. Double slit. Multiple slits. Diffraction grating. Resolving power of grating.

Fresnel Diffraction: Fresnel's Assumptions. Fresnel's Half-Period Zones for Plane Wave. Explanation of Rectilinear Propagation of Light. Theory of a Zone Plate: Multiple Foci of a Zone Plate. Fresnel's Integral, Fresnel diffraction pattern of a straight edge, a slit and a wire. 12 **L**

Text book [TB]:

1. Optics, Ajoy Ghatak, McGraw Hill Education, 2017.
2. The Physics of Waves and Oscillations, N.K. Bajaj, Tata McGraw Hill, 2004

Reference books [RB]:

1. The physics of vibrations and waves, H. J. Pain, Wiley, 2010
2. Fundamentals of Optics, F.A. Jenkins and H.E. White, McGraw-Hill, 2011.

SR.NO.	LIST OF EXPERIMENTS
1	(a) To determine wavelength of sodium light using Newton's Rings. (b) To determine the refractive index of a liquid using Newton's Rings.
2	To determine wavelength of sodium light using Fresnel's Biprism.
3	(a) To determine wavelength of prominent lines of mercury using plane diffraction grating. (b) To determine the dispersive power of a plane transmission diffraction grating.
4	To determine the specific rotation of cane sugar solution using bi-quartz polarimeter
5	To study the diffraction pattern of Single slit and hence determine the slit width.
6	(a) To verify cosine square law (Malus Law) for plane polarized light. (b) To study the nature of polarization using a quarter wave plate.
7	To study the variation of refractive index of the material of the prism with wavelength and to verify Cauchy's dispersion formula

8	(a) To study photoelectric effect and determine the value of Planck's constant. (b) To verify inverse square law using photocell.
9	To determine the frequency of AC mains using sonometer.
10	To determine the frequency of AC mains or of an electric vibrator by Melde's experiment
11	To measure the numerical aperture (NA) of an optical fiber.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	Physics
2. Course Code	PYF206
3. Course Title	Mathematical Physics-II
4. Credits (L:T:P:C)	3:1:0:4
5. Contact Hours (L:T:P)	3:1:0
6. Prerequisites (if any)	Mathematical Physics I
7. Course Basket	Discipline Core

COURSE SUMMARY:

This course covers Fourier Series, Frobenius method and special functions, special integrals, partial differential equations and theory of errors.

COURSE OBJECTIVE:

The objectives of this course are to:
Introduce students to the use of mathematical methods to solve various physics problems.
Provide students with basic skills necessary for the application of mathematical methods in physics.

Course Pre/Co- requisite (if any) :no restricted pre-requisite

COURSE OUTCOME

Upon completion of this course, students should be able to:

1. Know various types of periodic functions including Fourier expansions and explain how these functions can be used in physics. Use Fourier transform to obtain the Fourier series of periodic functions in physics.
2. Know various second order differential equations viz. Legendre, Bessel, Hermite and Laguerre Differential Equations.
3. Identify different special mathematical functions. Applying special mathematical functions appropriately in solving problems in physics.
4. Know the theory of error which has great importance in physics.
5. Know of partial differential equations in Cartesian, spherical and cylindrical systems. Because so many problems in quantum mechanics can be solved by transformation of one coordinate system to others.

CURRICULUM CONTENT

Unit 1:

Fourier Series: Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Even and odd functions and their Fourier expansions. Expansion of functions with arbitrary period with application. Parseval Identity. 7 L

Unit 2:

Frobenius Method and Special Functions: Singular Points of Second Order Linear Differential Equations and their importance. Frobenius method and its applications to differential equations. Legendre, Bessel, Hermite and Laguerre Differential Equations. Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality. Simple recurrence relations. 15 L

Unit 3:

Some Special Integrals: Beta and Gamma Functions and Relation between them. Expression of Integrals in terms of Gamma Functions. Error Function (Probability Integral). 4 L

Unit-4:

Theory of Errors: Systematic and Random Errors. Propagation of Errors. Normal Law of Errors. Standard and Probable Error. 4 L

Unit- 5:

Partial Differential Equations: Solutions to partial differential equations, using separation of variables: Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry. Wave equation and its solution for vibrational modes of a stretched string, rectangular and circular membranes. 9 L

Text book [TB]:

1. Mathematical Methods for Physicists, Arfken, Weber, Harris, Elsevier, 2005.
2. Mathematical Physics, H. K. Das, S. Chand & Company, 2005
3. Fourier Analysis by M.R. Spiegel, Tata McGraw-Hill, 2004.
4. Mathematics for Physicists, Susan M. Lea, Thomson Books/Cole, 2004.

Reference books [RB]:

1. Differential Equations, George F. Simmons, Tata McGraw-Hill, 2006.
2. Partial Differential Equations for Scientists & Engineers, S.J. Farlow, Dover Pub., 1993.
3. Mathematical methods for Scientists & Engineers, D.A. McQuarrie, Viva Books, 2003.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	Physics
2. Course Code	PYF207
3. Course Title	Thermal Physics
4. Credits (L:T:P:C)	3:1:4:6
5. Contact Hours (L:T:P)	3:1:4
6. Prerequisites (if any)	None
7. Course Basket	Discipline Core

COURSE SUMMARY:

This course covers temperature, heat exchange, heat capacity, phases of matter, ideal gas law, kinetic theory of gases, zeroth, first, second and third law of thermodynamics, entropy and their applications.

COURSE OBJECTIVE:

The objective of this course is to develop a working knowledge of the laws and methods of thermodynamics and elementary statistical mechanics and to use this knowledge to explore various applications. Many of these applications will relate to topics in materials science and the physics of condensed matter.

Course Pre/Co- requisite (if any) :no restricted pre-requisite

COURSE OUTCOME

Having successfully completed this course, the student will be able to:

1. State the Zeroth, First, Second and Third Laws of thermodynamics, if appropriate in different but equivalent forms and demonstrate their equivalence
2. Understand all the concepts needed to state the laws of thermodynamics, such as 'thermodynamic equilibrium', 'exact' and 'inexact' differentials and 'reversible' and 'irreversible' processes
3. Use the laws of thermodynamics (particularly the first and second laws) to solve a variety of problems, such as the expansion of gases and the efficiency of heat engines
4. Understand the meaning and significance of state variables in general, and of the variables P; V; T;U; S in particular, especially in the context of a simple fluid, and to manipulate these variables to solve a variety of thermodynamic problems
5. Understand the efficiency and properties of thermodynamic cycles for heat engines, refrigerators and heat pumps.
6. Define the enthalpy H, Helmholtz function F and the Gibbs function G and state their roles in determining equilibrium under different constraints

CURRICULUM CONTENT

Unit 1: Introduction to Thermodynamics

Zeroth and First Law of Thermodynamics: Extensive and intensive Thermodynamic Variables, Thermodynamic Equilibrium, Zeroth Law of Thermodynamics & Concept of Temperature, Concept of Work & Heat, State Functions, First Law of Thermodynamics and its differential form,

Internal Energy, First Law & various processes, Applications of First Law: General Relation between C_P and C_V, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Co-efficient.

Second Law of Thermodynamics: Reversible and Irreversible process with examples. Conversion of Work into Heat and Heat into Work. Heat Engines. Carnot's Cycle, Carnot engine & efficiency. Refrigerator & coefficient of performance, 2nd Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence. Carnot's Theorem. Applications of Second Law of Thermodynamics: Thermodynamic Scale of Temperature and its Equivalence to Perfect Gas Scale. 10 L

Unit 2: Entropy

Concept of Entropy, Clausius Theorem. Clausius Inequality, Second Law of Thermodynamics in terms of Entropy. Entropy of a perfect gas. Principle of Increase of Entropy. Entropy Changes in Reversible and Irreversible processes with examples. Entropy of the Universe. Entropy Changes in Reversible and Irreversible Processes. Principle of Increase of Entropy. Temperature–Entropy diagrams for Carnot's Cycle. Third Law of Thermodynamics. Unattainability of Absolute Zero. 6 L

Unit 3: Thermodynamic Potentials

Extensive and Intensive Thermodynamic Variables. Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy. Their Definitions, Properties and Applications. Magnetic Work, Cooling due to adiabatic demagnetization, First and second order Phase Transitions with examples, Clausius Clapeyron Equation and Ehrenfest equations 5 L

Unit-4: Maxwell's Thermodynamic Relations

Maxwell's Thermodynamic Relations: Derivations and applications of Maxwell's Relations, Maxwell's Relations:(1) Clausius Clapeyron equation, (2) Values of Cp-Cv, (3) Tds Equations, (4) Joule-Kelvin coefficient for Ideal and Van der Waal Gases, (5) Energy equations, (6) Change of Temperature during Adiabatic Process.

4 L

Unit- 5:Kinetic Theory of Gases

Distribution of Velocities: Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas and its Experimental Verification. Mean, RMS and Most Probable Speeds. Degrees of Freedom. Law of Equipartition of Energy (No proof required). Specific heats of Gases.

Molecular Collisions: Mean Free Path. Collision Probability. Estimates of Mean Free Path. Transport Phenomenon in Ideal Gases: (1) Viscosity, (2) Thermal Conductivity and (3) Diffusion. Brownian Motion and its Significance.

Real Gases: Behavior of Real Gases: Deviations from the Ideal Gas Equation. The Virial Equation. Andrew's Experiments on CO2 Gas. Critical Constants. Continuity of Liquid and Gaseous State. Vapour and Gas. Boyle Temperature. Van der Waal's Equation of State for Real Gases. Values of Critical Constants. Law of Corresponding States. Comparison with Experimental Curves. p-V Diagrams. Joule's Experiment. Free Adiabatic Expansion of a Perfect Gas. Joule-Thomson Porous Plug Experiment. JouleThomson Effect for Real and Van der Waal Gases. Temperature of Inversion. JouleThomson Cooling

14L

Text book [TB]:

1. Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, McGraw-Hill, 1981.
2. Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, Tata McGraw-Hill, 1993

Reference books [RB]:

1. A Treatise on Heat, MeghnadSaha, and B.N.Srivastava, Indian Press, 1958
2. Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, Springer, 2009.
3. Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger, Narosa, 1988.
4. Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, 2nd Ed, Oxford University Press., 2012

SR.NO.	LIST OF EXPERIMENTS
1	To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2	To determine the Coefficient of Thermal Conductivity of Cu by Searle's Apparatus.
3	To determine the Coefficient of Thermal Conductivity of Cu 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 calibrate a Resistance Temperature Device (RTD) to measure temperature in a specified range using Null Method/ Off-Balance Bridge with Galvanometer based Measurement.
6	To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT).
7	To study the variation of Thermo-Emf 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 Op-Amp difference amplifier and to determine Neutral Temperature.
9	Determine a high resistance by leakage method using Ballistic Galvanometer.

1. Department offering the course	Physics
2. Course Code	PYF218
3. Course Title	Analog Systems and Applications
4. Credits (L:T:P:C)	3:1:4:6
5. Contact Hours (L:T:P)	3:1:4
6. Prerequisites (if any)	None
7. Course Basket	Discipline Core

COURSE SUMMARY:

This is a course on the design and applications of analog integrated circuits. This course introduces basic op-amp principles and show how the op-amp can be used to solve a variety of application problems. Much attention is given to basic op-amp configurations, linear and non-linear applications of op-amp and active filter synthesis, including switched capacitor configurations. It also deals with oscillators, waveform generators and data converters.

COURSE OBJECTIVE:

To inculcate the knowledge about basics of electronics in students.
To demonstrate the use of analog electronics devices for different applications.

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

1. The basics of electronics such as barrier formation in PN junction diode.
2. The different types of diodes and their application as rectifiers and voltage regulator.
3. The characteristics of Bipolar Junction Transistors in different configurations.
4. The RC circuits and their use with BJTs in Amplifiers and Oscillators.
5. The concept of differential amplifier and use of Operational amplifier for different applications.

CURRICULUM CONTENT

UNIT 1

Semiconductor Diodes: P and N type semiconductors. Energy Level Diagram. Conductivity and Mobility, Concept of Drift velocity. Barrier Formation in PN Junction Diode. Static and Dynamic Resistance. Current Flow Mechanism in Forward and Reverse Biased Diode. Drift Velocity. Derivation for Barrier Potential, Barrier Width and Current for Step Junction. 8 L

UNIT 2

Two-terminal Devices and their Applications: (1) Rectifier Diode: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers, Calculation of Ripple Factor and Rectification Efficiency, (2) Zener Diode and Voltage Regulation. Principle and structure of (1) LEDs, (2) Photodiode, (3) Solar Cell.
8 L

UNIT 3

Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. Current gains α and β Relations between α and β. Load Line analysis of Transistors. DC Load line and Q-point. Physical Mechanism of Current Flow. Active, Cutoff and Saturation Regions.

8 L

UNIT 4

Amplifiers: Transistor Biasing and Stabilization Circuits. Coupled Amplifier: RC-coupled amplifier and its frequency response. Feedback in Amplifiers: Effects of Positive and Negative Feedback on Input Impedance, Output Impedance, Gain, Stability, Distortion and Noise.
Sinusoidal Oscillators: Barkhausen's Criterion for self-sustained oscillations. RC Phase shift oscillator, determination of Frequency. Hartley & Colpitts oscillators. 8 L

UNIT 5

loop and Closed-loop Gain. Frequency Response. CMRR. Slew Rate and concept of Virtual ground.
Applications of Op-Amps: (1) Inverting and non-inverting amplifiers, (2) Adder, (3) Subtractor, (4) Differentiator,
(5) Integrator, (6) Log amplifier, (7) Zero crossing detector (8) Wein bridge oscillator. (9 Lectures)
Conversion: Resistive network (Weighted and R-2R Ladder). Accuracy and Resolution. A/D and D/A Converter.

7 L

Text book [TB]:

1. Solid State Electronic Devices, B.G.Streetman&S.K.Banerjee, PHI Learning, 2015.
2. Electronic Devices & circuits, S.Salivahanan&N.S.Kumar, Tata Mc-Graw Hill, 2011.
3. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, Prentice Hall, 2007.
4. Electronic circuits: Handbook of design & applications, U.Tietze, C.Schenk, Springer, 2015.

Reference books [RB]:

1. Electronics: Fundamentals and Applications, J.D. Ryder, Prentice Hall, 1974.
2. Semiconductor Devices: Physics and Technology, S.M. Sze, Wiley India, 2012.
3. Integrated Electronics, J. Millman and C.C. Halkias, Tata Mc-Graw Hill, 2001.

SR.NO.	LIST OF EXPERIMENTS
1	To study V-I characteristics of PN junction diode.
2	To study the V-I characteristics of a Zener diode and its use as voltage regulator.
3	Study of V-I & power curves of solar cells, and find maximum power point & efficiency.
4	To study the characteristics of a Bipolar Junction Transistor in CE configuration.
5	To design a CE transistor amplifier of a given gain (mid-gain) using voltage divider bias.
6	To study the frequency response of voltage gain of a RC-coupled transistor amplifier.

7	To design a Wien bridge oscillator for given frequency using an op-amp.
8	To design a phase shift oscillator of given specifications using BJT.
9	To study the Colpitt`s oscillator.
10	To investigate the use of an op-amp as an Integrator.
11	To investigate the use of an op-amp as a Differentiator.
12	To design a circuit to simulate the solution of a 1st/2nd order differential equation.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	Physics
2. Course Code	PYF216
3. Course Title	Mathematical Physics-III
4. Credits (L:T:P:C)	3:1:0:4
5. Contact Hours (L:T:P)	3:1:0
6. Prerequisites (if any)	Mathematical Physics-II
7. Course Basket	Discipline Core

COURSE SUMMARY:

The course covers analysis of complex variables, Fourier and Laplace transforms which find applications in advanced courses during Masters in Physics.

Course Objective:

The emphasis of the course is on applications in solving problems of interest to physicists. Students are to be examined on the basis of problems, seen and unseen.

Course Pre/Co- requisite (if any): The student must have gone through Mathematical Physics-I PY106

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

1. The use of Complex Numbers and Residues and Residue Theorem
2. The use of singular functions, and poles, branch points, order of singularity etc.
3. The use ofFourier Integral theorem and properties of Fourier transforms
4. The application of Fourier Transforms as 1D Wave and Diffusion/Heat Flow Equations
5. The use of Laplace Transform (LT) of Elementary functions
6. The application of change of scale theorem and shift theorem

CURRICULUM CONTENT

Unit 1: Complex Analysis

Brief Revision of Complex Numbers, Functions of Complex Variables Analyticity and Cauchy-Riemann Conditions, Examples of analytic functions, Singular functions: poles and branch points, order of singularity, branch cuts, Integration of a function of a complex variable, Cauchy's Integral formula. Laurent and Taylor's expansion. ResiduesandResidueTheorem. 20 L

Unit 2: Fourier Transforms

Fourier Integral theorem. Fourier Transform. Examples, Representation of Dirac delta function as a Fourier Integral, Inverse Fourier transform, Convolution theorem. Properties of Fourier transforms, Three dimensional Fourier transforms with examples, application of Fourier Transforms to differential equations: One dimensional Wave and Diffusion/Heat Flow Equations. 10 L

Unit 3: Laplace Transforms

Laplace Transform (LT) of Elementary functions, Properties of LTs: Change of Scale Theorem, Shifting Theorem, LTs of Derivatives and Integrals of Functions, Derivatives and Integrals of LTs, Convolution Theorem. Inverse LT. Applications of Laplace Transforms. 10 L

Text book [TB]:

1. Mathematical Physics, H. K. Das, S. Chand & Company, 2010
2. Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, 3rd ed, Cambridge University Press., 2006
3. Mathematics for Physicists, P. Dennery and A.Krzywicki, Dover Publications, 1996

Reference books [RB]:

1. Complex Variables, A.S.Fokas&M.J.Ablowitz, 8th Ed, Cambridge Univ. Press., 2011
2. Complex Variables and Applications, J.W. Brown & R.V. Churchill, 7th Ed, Tata McGraw-Hill, 2003
3. First course in complex analysis with applications, D.G. Zill and P.D. Shanahan, Jones & Bartlett, 1940,

1. Department offering the course	Physics
2. Course Code	PYF217
3. Course Title	Elements of Modern Physics
4. Credits (L:T:P:C)	3:1:4:6
5. Contact Hours (L:T:P)	3:1:4
6. Prerequisites (if any)	Waves and Optics
7. Course Basket	Discipline Core

COURSE SUMMARY:

In this course, the students will get an introductory approach on various branches of physics like quantum mechanics, atomic, molecular and nuclear physics which will establish their fundamental base for learning these subjects separately.

Course Objective:

Students will apply understanding and skill related to the principles and concepts of modern physics essential for graduate school and/or professional employment in the field

COURSE OUTCOME

Having successfully completed this course, the student will be able to:

1.Outline the scientific foundation for modern physics according the Course Main Content
2.Perform quantum mechanical calculation for simple systems
3.Apply quantum mechanical principles in science and technology
4.Outline the most important experimental methods in modern physics

CURRICULUM CONTENT

UNIT 1

Planck's quantum, Planck's constant and light as a collection of photons; Blackbody Radiation: Quantum theory of Light; Photo-electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment. Wave description of particles by wave packets. Group and Phase velocities and relation between them. 6 L

UNIT 2

Position measurement-gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle (Uncertainty relations involving Canonical pair of variables): Derivation from Wave Packets impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle- application to virtual particles and range of an interaction. 6 L

UNIT 3

Linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of a wave function, probabilities and normalization; Probability and probability current densities in one dimension.

One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum dot as example; Quantum mechanical scattering and tunnelling in one dimension-across a step potential & rectangular potential barrier. 11 L

UNIT 4

Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, Liquid Drop model: semi-empirical mass formula and binding energy, Nuclear Shell Model and magic numbers.

Law of radioactive decay; Mean life and half-life; Alpha decay; Beta decay- energy released, spectrum and Pauli's prediction of neutrino; Gamma ray emission, energy-momentum conservation

Fission and fusion- mass deficit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium 235 10 L

UNIT 5

Lasers: Einstein's A and B coefficients. Metastable states. Spontaneous and Stimulated emissions. Optical Pumping and Population Inversion. Ruby Laser and He-Ne Laser. 6 L

Text book [TB]:

1. Concepts of Modern Physics, Arthur Beiser, McGraw-Hill, 2002,
2. Introduction to Modern Physics, Rich Meyer, Kennard, Coop, Tata McGraw Hill, 2002
3. Introduction to Quantum Mechanics, David J. Griffith, Pearson Education, 2005
4. Physics for scientists and Engineers with Modern Physics, Jewett and Serway, Cengage Learning, 2010
5. Quantum Mechanics: Theory & Applications, A.K.Ghatak & S.Lokanathan, Macmillan, 2004

Reference books [RB]:

1. Modern Physics, J.R. Taylor, C.D. Zafiratos, M.A. Dubson, PHI Learning, 2004
2. Theory and Problems of Modern Physics, Schaum`s outline, R. Gautreau and W. Savin, 2nd Edn, Tata McGraw-Hill Publishing Co. Ltd.
3. Quantum Physics, E.H.Wichman, Vol.4., Berkeley Physics, Tata McGraw-Hill Co, 1971
4. Basic ideas and concepts in Nuclear Physics, K.Heyde, 3rd Edn., Institute of Physics Pub.
5. Six Ideas that Shaped Physics: Particle Behave like Waves, T.A.Moore, McGraw Hill, 2003

SR. NO.	LIST OF EXPERIMENTS
1	Measurement of Planck's constant using black body radiation and photo-detector
2	Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light
3	To determine work function of material of filament of directly heated vacuum diode.
4	To determine the Planck's constant using LEDs of at least 4 different colours
5	To determine the wavelength of H-alpha emission line of Hydrogen atom.
6	To determine the ionization potential of mercury.
7	To determine the absorption lines in the rotational spectrum of Iodine vapour.
8	To determine the value of e/m by Thomson Method.

9	To setup the Millikan oil drop apparatus and determine the charge of an electron.
10	To show the tunneling effect in tunnel diode using I-V characteristics.
11	To study the atomic spectra of a 2 electron system
12	To determine Lande's g factor using electron spin resonance spectrometer

1. Department offering the course	Physics
2. Course Code	PYF208
3. Course Title	Digital Systems and Applications
4. Credits (L:T:P:C)	3:1:4:6
5. Contact Hours (L:T:P)	3:1:4
6. Prerequisites (if any)	Analog Systems and Applications
7. Course Basket	Discipline Core

COURSE SUMMARY:

This course provides an in depth study of the principles and applications of digital systems . The course covers the basic building blocks of digital systems and the process of building a digital design project and testing it. The laboratory exercises are designed to complement the theory of digital circuits

Course Objective:

To inculcate the knowledge in students about the logic circuits and their applications.
To demonstrate the knowledge of logic circuits & digital systems for various applications.

Course Pre/Co- requisite (if any) : Analog Systems and Applications

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

1. The binary, decimal and other numbers systems with their conversion.
2. Boolean algebra and use of simple logic gates for it.
3. The use of simple logic circuits in MUX, DMUX, encoder, decoders as data processing circuits.
4. The use of simple logic circuits in different sequential circuits.
5. The use of sequential circuits in registers, A/D & D/A converters.

CURRICULUM CONTENT

UNIT 1

Binary Numbers. Decimal to Binary and Binary to Decimal Conversion. BCD, Octal and Hexadecimal numbers. Negative and Positive logic, 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. 8 L

UNIT 2

Boolean algebra: De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra. Fundamental Products. Idea of Minterms and Max terms. Conversion of a Truth table into Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map. 8 L

UNIT 3

Data processing circuits: Basic idea of Multiplexers, De-multiplexers, Decoders, Encoders. (4 Lectures) Arithmetic Circuits: Binary Addition. Binary Subtraction using 2's Complement. Half and Full Adders. Half & Full Subtractors, 4-bit binary Adder/Subtractor. 8 L

UNIT 4

Sequential Circuits: SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop. M/S JK Flip-Flop. 8 L

UNIT 5

Astable multivibrator and Monostable multivibrator. Shift registers: Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits). (2

Lectures) Counters(4 bits): Ring Counter. Asynchronous counters, Decade Counter. Synchronous Counter. 7 L

Text book [TB]:

1. Digital Circuits and systems, Venugopal, Tata McGraw Hill, 2011.
2. Logic circuit design, Shimon P. Vingron, Springer, 2012.
3. Fundamentals of Digital Circuits, Anand Kumar, PHI Learning Pvt. Ltd., 2016.

Reference books [RB]:

1. Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, Tata McGraw, 2010.
2. Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, PHI Learning, 1985.

SR.NO.	LIST OF EXPERIMENTS
1	To measure (a) Voltage, and (b) Time period of a periodic waveform using CRO.
2	To test a Diode and Transistor using a Multimeter.
3	To design a switch (NOT gate) using a transistor.
4	To verify and design AND, OR, NOT and XOR gates using NAND gates.
5	To design a combinational logic system for a specified Truth Table.
6	To convert a Boolean expression into logic circuit and design it using logic gate ICs.
7	To minimize a given logic circuit.
8	Half Adder, Full Adder and 4-bit binary Adder.
9	Half Subtractor, Full Subtractor, Adder-Subtractor using Full Adder I.C.
10	To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates.
11	To build JK Master-slave flip-flop using Flip-Flop ICs
12	To build a 4-bit Counter using D-type/JK Flip-Flop ICs and study timing diagram.
13	To make a 4-bit Shift Register (serial and parallel) using D-type/JK Flip-Flop ICs.
14	To design an astable multivibrator of given specifications using 555 Timer.
15	To design a monostable multivibrator of given specifications using 555 Timer.

1. Department offering the course	Physics
2. Course Code	PYF306
3. Course Title	Quantum Mechanics and Applications
4. Credits (L:T:P:C)	3:1:0:4
5. Contact Hours (L:T:P)	3:1:0
6. Prerequisites (if any)	Mathematical Physics-II and Elements of Modern Physics
7. Course Basket	Discipline Core

COURSE SUMMARY:

This course covers Schrodinger's time dependent and time-independent wave equations and their applications to different bound potentials, quantum theory of hydrogen like atoms and the behavior of atoms in electric and magnetic fields.

Course Objective:

The objective of this course is to study the basic principles of quantum mechanics, explain the operator formulation of quantum mechanics, learn the concept of wave function, Schrodinger equation and their applications and to study role of uncertainty in quantum physics

Course Pre/Co- requisite (if any) : Mathematical Physics-II and Elements of Modern Physics

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

1. Pinpoint the historical aspects of development of quantum mechanics.
2. Understand and explain the differences between classical and quantum mechanics.
3. Understand the idea of wave function.
4. Understand the uncertainty relations.
5. Solve Schrodinger equation for simple potentials.

CURRICULUM CONTENT

UNIT 1: Time dependent Schrodinger equation

Time dependent Schrodinger equation and dynamical evolution of a quantum state; Properties of Wave Function. Interpretation of Wave Function Probability and probability current densities in three dimensions; Conditions for Physical Acceptability of Wave Functions. Normalization. Linearity and Superposition Principles. Eigenvalues and Eigenfunctions. Position, momentum and Energy operators; commutator of position and momentum operators; Expectation values of position and momentum. Wave Function of a Free Particle 7 L

UNIT 2: Time independent Schrodinger equation

Hamiltonian, stationary states and energy eigenvalues; expansion of an arbitrary wavefunction as a linear combination of energy eigenfunctions; General solution of the time dependent Schrodinger equation in terms of linear combinations of stationary states; Application to spread of Gaussian wave-packet for a free particle in one dimension; wave packets, Fourier transforms and momentum space wavefunction; Position-momentum uncertainty principle 8 L

UNIT 3: General discussion of bound states in an arbitrary potential

Application to one-dimensional problem-square well potential; Quantum mechanics of simple harmonic oscillator-energy levels and energy eigenfunctions using Frobenius method; Hermite polynomials; ground state, zero point energy & uncertainty principle 7 L

UNIT 4: Quantum theory of hydrogen-like atoms

Time independent Schrodinger equation in spherical polar coordinates; separation of variables for second order partial differential equation; angular momentum operator & quantum numbers; Radial wavefunctions from Frobenius method; shapes of the probability densities for ground & first excited states; Orbital angular momentum quantum numbers l and m; s, p, d,.. shells 7 L

UNIT 5: Atoms in Electric & Magnetic Fields

Electron angular momentum. Space quantization. Electron Spin and Spin Angular Momentum. Larmor's Theorem. Spin Magnetic Moment. Stern-Gerlach Experiment. Zeeman Effect: Electron Magnetic Moment and Magnetic Energy, Gyromagnetic Ratio and Bohr Magneton.

Atoms in External Magnetic Fields:- Normal and Anomalous Zeeman Effect. Paschen Back and Stark Effect (Qualitative Discussion only)

Many electron atoms: Pauli's Exclusion Principle. Symmetric & Antisymmetric Wave Functions. Fine structure. Spin orbit coupling. Spectral Notations for Atomic States. Total angular momentum. Vector Model. Spin-orbit coupling in atomsL-S and J-J couplings. Hund's Rule 10 L

Text book [TB]:

1. Introduction to Quantum Mechanics, D.J. Griffith, 2nd Ed., Pearson Education, 2016
2. Quantum Mechanics, Leonard I. Schiff, 3rd Edn., Tata McGraw Hill, 2017.

Reference books [RB]:

1. A Text book of Quantum Mechanics, P.M.Mathews and K.Venkatesan, 2nd Ed, McGraw Hill, 2017
2. Quantum Mechanics, Robert Eisberg and Robert Resnick, 2nd Edn., Wiley, 2006

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	Physics
2. Course Code	PYF307
3. Course Title	SOLID STATE PHYSICS
4. Credits (L:T:P:C)	3:1:4:6
5. Contact Hours (L:T:P)	3:1:4
6. Prerequisites (if any)	Electricity and Magnetism and Elements of Modern Physics
7. Course Basket	Discipline Core

COURSE SUMMARY:

The course covers the physical understanding of matter from an atomic view point. Topics covered include the structure, magnetic and electrical properties of matter. Fundamental theories in solid state physics are introduced and then extended to show the relevance to important applications in current -day technology, industry, and research. The course has a theoretical lecture component and makes extensive use of examples and exercises to illustrate the material.

Course Objective:

To study some of the basic properties of the condensed phase of materials especially solids and their application in interdisciplinary fields.

Course Pre/Co- requisite (if any): Electricity and Magnetism and Elements of Modern Physics

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

1. To understand the various crystal structures, types of crystal lattices, representation of cryal planes and directions and basic X ray diffraction.
2. To understand the vibrations in mono atomic lattice and basic theories of thermal conductivities.
3. To understand the dielectric / magnetic properties of solids and about Piezoelectric effect, Pyroelectric effect, Ferroelectric effect, Electrostrictive effect,
4. To understand the Electric transport in solids, basic properties of semiconductors and super conductors.

CURRICULUM CONTENT

UNIT 1

Crystal Structure: Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Central and Non-Central Elements. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. 7 L

UNIT 2

Elementary Lattice Dynamics: Lattice Vibrations and Phonons: Linear Monoatomic Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids. T^3 law. 7 L

UNIT 3

Magnetic Properties of Matter: Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia– and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss. 7 L

UNIT 4

Dielectric Properties of Materials: Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility. Polarizability. Clausius Mosotti Equation. Classical Theory of Electric Polarizability. Normal and Anomalous Dispersion. Cauchy and Sellmeir relations. Langevin-Debye equation. Complex Dielectric Constant. Optical Phenomena. Ferroelectric Properties of Materials: Structural phase transition, Classification of crystals, Piezoelectric effect, Pyroelectric effect, Ferroelectric effect, Electrostrictive effect, Curie-Weiss Law, Ferroelectric domains, PE hysteresis loop. 10 L

UNIT 5

Elementary band theory: Kronig Penny model. Band Gap. Conductor, Semiconductor (P and N type) and insulator. Conductivity of Semiconductor, mobility, Hall Effect. Measurement of conductivity (04 probe method) & Hall coefficient.

Superconductivity: Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect. Idea of BCS theory (No derivation) 8 L

Text book [TB]:

1. Introduction to Solid State Physics, Charles Kittel, 8th Edition, Wiley India Pvt. Ltd, 2004.
2. Elements of Solid State Physics, J.P. Srivastava, 2nd Edition, Prentice-Hall of India, 2006

Reference books [RB]:

1. Solid State Physics, M.A. Wahab, Narosa Publications, 2011
2. Solid state Physics, S. O. Pillai, New Age International publishers

1. Department offering the course	Physics
2. Course Code	PYF326
3. Course Title	ELECTROMAGNETIC THEORY
4. Credits (L:T:P:C)	3:1:0:4
5. Contact Hours (L:T:P)	3:1:0
6. Prerequisites (if any)	Electricity and Magnetism
7. Course Basket	Discipline Core

COURSE SUMMARY:

This course would be a pre-requisite for the advanced level course at the M. Sc. Level. The course begins with a review of Maxwell equations. The course covers reflection, refraction and polarization of electromagnetic waves at different media, optical fibres and wave guides.

Course Objective:
To acquire the understanding of Maxwell's equations and be able to solve practical EM field problems. Strong fundamental concepts like EM wave propagation in different media, powerflow, polarization, reflections and transmission & optical wave guides can be used in future for transmission, propagation & reception of EM waves in communication systems.
Course Pre/Co- requisite (if any): Electricity and Magnetism

COURSE OUTCOME
On successful completion of the course, students will be able to achieve the following:
1. The use of basic properties of EM wave.
2. Understanding of properties and solution of wave equation for EM fields in free space and matter.
3. Understanding of behavior of EM wave at boundaries.
4. Understanding of polarization of EM waves.
5. Understanding of basics of optical wave guides.
6. Problem solving skills.

CURRICULUM CONTENT

UNIT 1
Maxwell Equations: Review of Maxwell's equations. Displacement Current. Vector and Scalar Potentials. Gauge Transformations: Lorentz and Coulomb Gauge. Wave Equations. Plane Waves in Dielectric Media. Poynting Theorem and Poynting Vector. Electromagnetic (EM) Energy Density. Physical Concept of Electromagnetic Field Energy Density, Momentum Density and Angular Momentum Density. 7 L

UNIT 2
EM Wave Propagation in Unbounded Media: Plane EM waves through vacuum and isotropic dielectric medium, transverse nature of plane EM waves, refractive index and dielectric constant, wave impedance. Propagation through conducting media, relaxation time, skin depth. 8 L

UNIT 3
EM Wave in Bounded Media: Boundary conditions at a plane interface between two media. Reflection & Refraction of plane waves at plane interface between two dielectric media-Laws of Reflection & Refraction. Fresnel's Formulae for perpendicular & parallel polarization cases,

Brewster's law. Reflection & Transmission coefficients. Total internal reflection, evanescent waves. Metallic reflection (normal Incidence) 7 L

UNIT 4

Polarization of Electromagnetic Waves: Description of Linear, Circular and Elliptical Polarization. Propagation of E.M. Waves in Anisotropic Media. Fresnel's Formula. Uniaxial and Biaxial Crystals. Light Propagation in Uniaxial Crystal. Double Refraction. Polarization by Double Refraction. Nicol Prism. Ordinary & extraordinary refractive indices. Production & detection of Plane, Circularly and Elliptically Polarized Light. Phase Retardation Plates: Quarter-Wave and Half-Wave Plates. Optical Rotation. Biot's Laws for Rotatory Polarization. Fresnel's Theory of optical rotation. Calculation of angle of rotation. Experimental verification of Fresnel's theory. Specific rotation. Laurent's half-shade polarimeter. 10 L

UNIT 5

Wave Guides: Planar optical wave guides. Planar dielectric wave guide. Condition of continuity at interface. Phase shift on total reflection. Eigenvalue equations. Phase and group velocity of guided waves. Field energy and Power transmission.

Optical Fibres:- Numerical Aperture. Step and Graded Indices (Definitions Only).

Single and Multiple Mode Fibres (Concept and Definition Only). 8 L

Text book [TB]:

1. Introduction to Electrodynamics, D.J. Griffiths, 3rd Ed, Benjamin Cummings., 1998.
2. Electricity and Magnetism, D. Chattopadhyay, New Central Book Agency (P) Ltd, 2018.

Reference books [RB]:

1. Elements of Electromagnetics, M.N.O. Sadiku, Oxford University Press, 2001.

1. Department offering the course	Physics
2. Course Code	PYF327
3. Course Title	STATISTICAL MECHANICS
4. Credits (L:T:P:C)	3:1:0:4
5. Contact Hours (L:T:P)	3:1:0
6. Prerequisites (if any)	Thermal Physics
7. Course Basket	Discipline Core

COURSE SUMMARY:

The course gives an introduction to statistical mechanics and some important applications. The course discusses how probability theory can be used to derive relations between the microscopic and macroscopic properties of matter. Thermodynamic potentials. Phase space and distributions in phase space. Maxwell-Boltzmann distributions with applications. Statistical ensembles. Applications on crystals and gases. Quantum statistics, Bose-Einstein and Fermi-Dirac statistics, Bose-Einstein condensation. The basic theory for electrons in a metal.

Course Objective:

The objective of this course is to learn the properties of macroscopic systems using the knowledge of the properties of individual particles and their application in the various field of physical science.

Course Pre/Co- requisite (if any): Thermal Physics

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

1. Connection between statistics and thermodynamics and different ensemble theories to explain the behaviour of the systems.
2. Difference between classical statistics and quantum statistics.
3. Statistical behaviour of ideal Bose and Fermi systems.
4. Varius applications of the statistical mechanics in other field of science
5. Application and importance of the statistical mechanics in computation and computing.

CURRICULUM CONTENT

UNIT 1

Classical Statistics: Macrostate & Microstate, Elementary Concept of Ensemble, Phase Space, Entropy and Thermodynamic Probability, Maxwell-Boltzmann Distribution Law, Partition Function, Thermodynamic Functions of an Ideal Gas, Classical Entropy Expression, Gibbs Paradox, Sackur Tetrode equation, Law of Equipartition of Energy (with proof) – Applications to Specific Heat and its Limitations, Thermodynamic Functions of a Two-Energy Levels System, Negative Temperature. 10 L

UNIT 2

Classical Theory of Radiation: Properties of Thermal Radiation. Blackbody Radiation. Pure temperature dependence. Kirchhoff's law. Stefan-Boltzmann law: Thermodynamic proof. Radiation Pressure. Wien's Displacement law. Wien's Distribution Law. Saha's Ionization Formula. Rayleigh-Jean's Law. Ultraviolet Catastrophe. 8 L

UNIT 3

Quantum Theory of Radiation: Spectral Distribution of Black Body Radiation. Planck's Quantum Postulates. Planck's Law of Blackbody Radiation: Experimental Verification. Deduction of (1) Wien's Distribution Law, (2) Rayleigh-Jeans Law, (3) Stefan-Boltzmann Law, (4) Wien's Displacement law from Planck's law. 8 L

UNIT 4

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. 6 L

UNIT 5

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. 7 L

Text book [TB]:

1. Statistical Mechanics, R.K. Pathria, Butterworth Heinemann: 2nd Ed., Oxford University Press, 1996.
2. Statistical and Thermal Physics, S. Lokanathan and R.S. Gambhir., Prentice Hall, 1991
3. Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, Tata McGraw-Hill, 1993

Reference books [RB]:

1. Statistical Physics, Berkeley Physics Course, F. Reif, Tata McGraw-Hill, 2008

Discipline Electives (min 16 credits to be taken)

1. Department offering the course	Physics
2. Course Code	PYF346
3. Course Title	NUCLEAR AND PARTICLE PHYSICS
4. Credits (L:T:P:C)	3:1:0:4
5. Contact Hours (L:T:P)	3:1:0
6. Prerequisites (if any)	None
7. Course Basket	Discipline Specific Elective

COURSE SUMMARY:

The course starts with basic concepts of a nucleus and covers the phenomenology and experimental foundations of particle and nuclear physics including the fundamental forces and particles and composites.

Course Objective:

The emphasis of the course is on developing fundamental knowledge of nuclear and particle physics and the basic governing laws behind various phenomena.

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

1. Historical background of the nuclear physics
2. The various factors affecting the binding energy of the nucleus
3. Strength of nuclear forces and different nuclear models
4. Radioactive decays and kinematics of nuclear reactions
5. Various nuclear detectors, accelerators and particles

CURRICULUM CONTENT

UNIT 1

Familiarization with Nucleus: Geiger-Marsden Experiment, mass, size, binding energy, nuclear binding energy in terms of atomic binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot. 8 L

UNIT 2

Semi-emperical formula mass and significance of its various terms, condition of nuclear stability, Symmetric and asymmetric distribution of nucleons.

Two-nucleon problem- Nuclear spin and Parity of Deutron, Deutron as a special case of central potential, two nucleon separation energies. 8 L

UNIT 3

Nuclear Models: Liquid drop model approach, Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas), evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, concept of mean field, residual interaction, concept of nuclear force. 8 L

UNIT 4

Alpha decay- basics of α-decay processes, Gamow factor, Geiger Nuttall law, α-decay spectroscopy. β-decay-energy kinematics for β-decay, positron emission, electron capture, neutrino hypothesis.

Gamma decay-Gamma rays emission & kinematics, internal conversion.
Nuclear Reactions: Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, Pair production, neutron interaction with matter. 8 L

UNIT 5

Detector for Nuclear Radiations: Gas detectors, GM Counter, basic principle of Scintillation detectors and construction of photo-multiplier tube (PMT).
Particle Accelerators: Van-de Graaff generator (Tandem accelerator), Linear accelerator, Cyclotron, Synchrotrons.
Particle physics: Types of particles and their families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model. 8 L

Text book [TB]:

1. Introductory nuclear Physics by Kenneth S. Krane, Wiley India Pvt. Ltd., 2008.
2. Concepts of nuclear physics by Bernard L. Cohen., Tata Mcgraw Hill, 1998.
3. Introduction to the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004).

Reference books [RB]:

1. Radiation detection and measurement, G.F. Knoll, John Wiley & Sons, 2000.
2. Basic ideas and concepts in Nuclear Physics- An Introductory Approach by K. Heyde, IOP-Institute of Physics Publishing, 2004

1. Department offering the course	Physics
2. Course Code	PYF347
3. Course Title	Experimental Techniques
4. Credits (L:T:P:C)	3:0:2:4
5. Contact Hours (L:T:P)	3:0:2
6. Prerequisites (if any)	None
7. Course Basket	Discipline Specific Elective

COURSE SUMMARY:

The course covers basic requirements of a measurement system, study of signals and systems, shielding and grounding, transducers and industrial instrumentation and digital systems.

Course Objective:

This course aims to provide the knowledge about basic experimental techniques which will enable a strong background for research also.

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

1. Types of error and other statistical analysis of a given data
2. Various types of signals and sources of noise in a signal
3. Various method of grounding and shielding an instrument
4. Working principle and applications of different transducers
5. Working of vacuum pumps and their applications in different fields

CURRICULUM CONTENT

UNIT 1

Measurements: Accuracy and precision. Significant figures. Error and uncertainty analysis. Types of errors: Gross error, systematic error, random error. Statistical analysis of data (Arithmetic mean, deviation from mean, average deviation, standard deviation, chi-square) and curve fitting. Gaussian distribution. 8 L

UNIT 2

Signals and Systems: Periodic and aperiodic signals. Impulse response, transfer function and frequency response of first and second order systems. Fluctuations and Noise in measurement system. S/N ratio and Noise figure. Noise in frequency domain. Sources of Noise: Inherent fluctuations, Thermal noise, Shot noise, 1/f noise 6 L

UNIT 3

Shielding and Grounding: Methods of safety grounding. Energy coupling. Grounding. Shielding: Electrostatic shielding. Electromagnetic Interference. 3 L

UNIT 4

Transducers & industrial instrumentation (working principle, efficiency, applications): Static and dynamic characteristics of measurement Systems. Generalized performance of systems, Zero order first order, second order and higher order systems. Electrical, Thermal and Mechanical systems. Calibration. Transducers and sensors. Characteristics of Transducers. Transducers as electrical element and their signal conditioning. Temperature transducers: RTD, Thermistor, Thermocouples, Semiconductor type temperature sensors (AD590, LM35, LM75) and signal conditioning. Linear Position transducer: Strain gauge, Piezoelectric. Inductance change transducer: Linear variable differential transformer (LVDT), Capacitance change transducers. Radiation Sensors: Principle of Gas filled detector, ionization chamber, scintillation detector. 12 L

UNIT 5

Digital Multimeter: Comparison of analog and digital instruments. Block diagram of digital multimeter, principle of measurement of I, V, C. Accuracy and resolution of measurement.

Impedance Bridges and Q-meter: Block diagram and working principles of RLC bridge. Q-meter and its working operation. Digital LCR bridge.
Vacuum Systems: Characteristics of vacuum: Gas law, Mean free path. Application of vacuum. Vacuum system- Chamber, Mechanical pumps, Diffusion pump & Turbo Modular pump, Pumping speed, Pressure gauges (Pirani, Penning, ionization). 10 L

Text book [TB]:

1. Measurement, Instrumentation and Experiment Design in Physics and Engineering, M. Sayer and A. Mansingh, PHI Learning Pvt. Ltd, 1999.
2. Experimental Methods for Engineers, J.P. Holman, McGraw Hill, 2017
3. Introduction to Measurements and Instrumentation, A.K. Ghosh, 3rd Edition, PHI Learning Pvt. Ltd, 2012.

Reference books [RB]:

1. Instrumentation Devices and Systems, C.S. Rangan, G.R. Sarma, V.S.V. Mani, Tata McGraw Hill, 2017
2. Principles of Electronic Instrumentation, D. Patranabis, PHI Learning Pvt. Ltd, 2008

List of Experiments

SR.NO.	LIST OF EXPERIMENTS
1	Determine output characteristics of a LVDT & measure displacement using LVDT
2	Measurement of Strain using Strain Gauge
3	Measurement of level using capacitive transducer
4	To study the characteristics of a Thermostat and determine its parameters
5	Study of distance measurement using ultrasonic transducer
6	To measure the change in temperature of ambient using Resistance Temperature Device (RTD)
7	To design and study the Sample and Hold Circuit
8	Design and analyze the Clippers and Clampers circuits using junction diode
9	To plot the frequency response of a microphone
10	To measure Q of a coil and influence of frequency, using a Q-meter.

1. Department offering the course	Physics
2. Course Code	PYF349
3. Course Title	Basic Instrumentation Skills
4. Credits (L:T:P:C)	3:0:2:4
5. Contact Hours (L:T:P)	3:0:2
6. Prerequisites (if any)	None
7. Course Basket	Discipline Specific Elective

COURSE SUMMARY:

This course covers the basic concepts of an instrumentation systems, voltmeter, ammeter, analog and digital measuring devices, cathode ray oscilloscope, wave from generators and analyzers. It develops the fundamental base of students for studying advanced instrumentation systems in higher studies and also familiarizes the students with working principles of some basic instruments.

Course Objective:

This course is to get exposure with various aspects of instruments and their usage through hands-on mode

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

1. To apply knowledge of basic instruments to the higher study experiments
2. To design and conduct experiments, as well as to analyze and interpret data
3. To function on multidisciplinary teams
4. To design new circuits and experiments
5. To use the techniques, skills, and modern engineering tools necessary for instrumentation

CURRICULUM CONTENT

Unit 1: Basic of Measurement

Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects, Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance, specifications of a multimeter and their significance.

7 L

Unit 2: Electronic Voltmeter

Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity, principles of voltage, measurement (block diagram only), specifications of an electronic voltmeter and its significance. AC millivoltmeter: Type of AC millivoltmeters, amplifier- rectifier, and rectifier- amplifier, block diagram ac millivoltmeter and its significance.

7 L

Unit 3: Cathode Ray oscilloscope

Block diagram of basic CRO, construction of CRT, electron gun, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, visual persistence & chemical composition, time base operation, synchronization, front panel controls, specifications of a CRO its significance and uses. 9 L

Unit-4: Signal Generators and Analysis Instruments

Block diagram, explanation and specifications of low frequency signal generators. pulse generator, and function generator and wave analysis. 7 L

Unit- 5: Impedance Bridges & Q-Meters, Digital Multimeter

Working principles and specifications of basic (balancing type) RLC bridge, digital LCR bridges, block diagram & working principles of a Q- Meter

Principle and working of digital meters, comparison of analog & digital instruments, working principles of digital voltmeter, block diagram and working of a digital multimeter, working principle of time interval, frequency and period measurement using universal counter/ frequency counter, time- base stability, accuracy and resolution. 10 L

Text book [TB]:

1. A text book in Electrical Technology, B L Theraja, S Chand and Co. 2005

Reference books [RB]:

1. Electronic Devices and circuits, S. Salivahanan & N. S.Kumar, 3rd Ed, Tata Mc-Graw Hill., 2012
2. Digital Electronics, Subrata Ghoshal, Cengage Learning, 2012

SR.NO.	LIST OF EXPERIMENTS
1	To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.
2	To observe the limitations of a multimeter for measuring high frequency voltage and currents.
3	To measure Q of a coil and its dependence on frequency, using a Q- meter.
4	Measurement of voltage, frequency, time period and phase angle using CRO.
5	Measurement of time period, frequency, average period using universal counter/ frequency counter.
6	Measurement of rise, fall and delay times using a CRO.
7	Measurement of distortion of a RF signal generator using distortion factor meter.
8	Measurement of R, L and C using a LCR bridge/ universal bridge.

1. Department offering the course	Physics
2. Course Code	PYF348
3. Course Title	Physics of Devices and Instrumentations
4. Credits (L:T:P:C)	3:0:2:4
5. Contact Hours (L:T:P)	3:0:2
6. Prerequisites (if any)	None
7. Course Basket	Discipline Specific Elective

COURSE SUMMARY:

The course covers semiconductor-based devices, power supply and filters, multivibrators, phase locked loops, basics of IC fabrication, digital data communication standards.

Course Objective:

The emphasis of the course is to learn the physics behind the working of semiconductor devices and their use in instrumentation.

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

1. Characteristics of basic semiconductor devices such as UJT, JFET, MOSFET, etc.
2. Power supply for a required circuit and application of various types of filters in it.
3. Manufacturing of passive components using various processing techniques.
4. Inter-devices for communication.
5. Modulation techniques for communication purpose.

CURRICULUM CONTENT

UNIT 1

Devices: Characteristic and small signal equivalent circuits of UJT and JFET. Metal semiconductor Junction. Metal oxide semiconductor (MOS) device. Ideal MOS and Flat Band voltage. SiO2-Si based MOS. MOSFET– their frequency limits. Enhancement and Depletion Mode MOSFETS, CMOS. Charge coupled devices. Tunnel diode. 8 L

UNIT 2

Power supply and Filters: Block Diagram of a Power Supply, Qualitative idea of C and L Filters. IC Regulators, Line and load regulation, Short circuit protection Active and Passive Filters, Low Pass, High Pass, Band Pass and band Reject Filters Multivibrators: Astable and Monostable Multivibrators using transistors. 8 L

UNIT 3

Phase Locked Loop(PLL): Basic Principles, Phase detector(XOR & edge triggered), Voltage Controlled Oscillator (Basics, varactor). Loop Filter– Function, Loop Filter Circuits, transient response, lock and capture. Basic idea of PLL IC (565 or 4046).

8 L

UNIT 4

Processing of Devices: Basic process flow for IC fabrication, Electronic grade silicon. Crystal plane and orientation. Defects in the lattice. Oxide layer. Oxidation Technique for Si. Metallization technique. Positive and Negative Masks. Optical lithography. Electron lithography. Feature size control and wet anisotropic etching. Lift off Technique. Diffusion and implantation.

8 L

UNIT 5

Digital Data Communication Standards: Serial Communications: RS232, Handshaking, Implementation of RS232 on PC. Universal Serial Bus (USB): USB standards, Types and

elements of USB transfers. Devices (Basic idea of UART). Parallel Communications: General Purpose Interface Bus (GPIB), GPIB signals and lines, Handshaking and interface management, Implementation of a GPIB on a PC. Basic idea of sending data through a COM port.
Introduction to communication systems: Block diagram of electronic communication system, Need for modulation. Amplitude modulation. Modulation Index. Analysis of Amplitude Modulated wave. Sideband frequencies in AM wave. CE Amplitude Modulator. Demodulation of AM wave using Diode Detector. basic idea of Frequency, Phase, Pulse and Digital Modulation including ASK, PSK, FSK 8 L

Text book [TB]:

1. Physics of Semiconductor Devices, S.M. Sze & K.K. Ng, 3rd Ed.2008, John Wiley & Sons
2. Electronic devices and integrated circuits, A.K. Singh, 2011, PHI Learning Pvt. Ltd.
3. Op-Amps & Linear Integrated Circuits, R.A.Gayakwad,4 Ed. 2000,PHI Learning Pvt. Ltd

Reference books [RB]:

1. Electronic Devices and Circuits, A. Mottershead, PHI Learning Pvt. Ltd, 1998.
2. Electronic Communication systems, G. Kennedy, Tata McGraw Hill, 1999.
3. Introduction to Measurements & Instrumentation, A.K. Ghosh, 3rd Ed PHI Learning Pvt. Ltd., 2009
4. PC based instrumentation; Concepts & Practice, N.Mathivanan, Prentice-Hall of India, 2007

SR.NO.	LIST OF EXPERIMENTS
1	To design a power supply using bridge rectifier and study effect of C-filter
2	To design the active Low pass and High pass filters of given specification
3	To design the active filter (wide band pass and band reject) of given specification
4	To study the output and transfer characteristics of a JFET.
5	To design a common source JFET Amplifier and study its frequency response.
6	To study the output characteristics of a MOSFET
7	To study the characteristics of a UJT and design a simple Relaxation Oscillator
8	To design an Amplitude Modulator using Transistor
9	To design PWM, PPM, PAM and Pulse code modulation using ICs.
10	To design an Astable multivibrator of given specifications using transistor

1. Department offering the course	Physics
2. Course Code	PYF356
3. Course Title	Computational Physics – I
4. Credits (L:T:P:C)	3:1:0:4
5. Contact Hours (L:T:P)	3:1:0
6. Prerequisites (if any)	None
7. Course Basket	Discipline Specific Elective

COURSE SUMMARY: This course includes the basic introduction of Matlab which contain creating and running m-files, writing codes in m-files. Further, it includes writing codes for applying to solve mathematical problems such as finding roots of equation, differentiation, integration, solution of ODE and PDE. Operations on matrices and plotting of functions are also included in this course.

Course Objective:

The objective of this course are:

To Impart the Knowledge to the students with MATLAB software.

To introduce the basic operations of MATLAB.

To provide a working introduction to the MATLAB technical computing environment.

To introduce students the use of a high-level programming language, MATLAB.

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

At the end of this course, the student will be able to

1. Understand the basics of MATLAB.
2. Break a complex task up into smaller, simpler tasks.
3. Able to access MATLAB and of use MATLAB *help* facility.
4. Do simple (but large) calculations and print out graphs.

CURRICULUM CONTENT

UNIT 1

Introduction to MATLAB: vector and matrix generation, subscripting and the colon notation, matrix and array operations and their manipulations, introduction to some inbuilt functions related to array operations. m-files: scripts and functions, editing, saving m-_les, and interaction between them. 6L

UNIT 2

Two & three-dimensional graphics: basic plots, change in axes and annotation in a figure, multiple plots in a _gure, saving and printing _gures, mesh plots, surface plots and their variants. 8L

UNIT 3

Relational and logical operators: control using various statements and loops including If-End statement, If-Else-End statement, nested If-Else-End statement, For-End and While-End loops with Break commands. 8L

UNIT 4

Introduction to built in functions: related to matrix inversion, eigenvalues, eigenvectors, condition number; for data representation: bar charts, histograms, pie chart, stem plots etc., for solving various type of differential equations; for specialized plotting e.g., contour plots, sphere, and animations.

10L

Text book [TB]:

1. **MATLAB: An introduction with applications**. Amos Gilat, John Wiley & Sons; 5th edition, 2014.

Reference books [RB]:

1. **Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers**. Rudra Pratap,Oxford; Edition edition, 2010.
2. **Applied Numerical Methods with Matlab for Engineers and Scientists**. Steven Chapra, McGraw-Hill Education; 3 edition, 2011.

1. Department offering the course	Physics
2. Course Code	PYF357
3. Course Title	Advanced Mathematical Physics
4. Credits (L:T:P:C)	3:1:0:4
5. Contact Hours (L:T:P)	3:1:0
6. Prerequisites (if any)	None
7. Course Basket	Discipline Specific Elective

COURSE SUMMARY:
The course covers vector space, linear transformations, tensors and calculus of variations which will develop a strong fundamental base for research in theoretical physics

Course Objective:

The key objective of this course is to familiarize students with a range of essential mathematical tools for solving the advanced problems in theoretical physics.

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

1. To acquire skills and knowledge among the students about real, complex numbers and their applications.
2. Enable students to understand Fourier series and its application in different fields.
3. Provide the knowledge and understanding of linear transformation and operator in various fields of physics.
4. Understanding the tensor analysis and its applications.
5. To acquire the knowledge of calculus of variations.

CURRICULUM CONTENT

UNIT 1
Linear Algebra: Vector Spaces: Vector Spaces over Fields of Real and Complex numbers. Linear independence of vectors. Basis and dimension of a vector space. Change of basis. Subspace. Isomorphisms. Inner product of functions: the weight function. Triangle and Cauchy Schwartz InequalitiesSine and cosine functions in a Fourier series as an orthonormal basis. 9 L

UNIT 2
Linear Transformations: Introduction. Identity and inverse. Singular and non-singular transformations. Representation of linear transformations by matrices. Linear operators. Differential operators as linear operators on vector space of functions. Commutator of operators. Orthogonal and unitary operators and their matrix representations. Hermitian operators and their matrix representation. Properties of eigenvalues and eigenvectors of Hermitian and unitary operators. 9 L

UNIT 3
Tensors: Tensors as multilinear transformations (functionals) on vectors. Examples: Moment of Inertia, dielectric susceptibility. Components of a tensor in basis. Symmetric and antisymmetric tensors. The completely antisymmetric tensor. Non-orthonormal and reciprocal bases. Inner product of vectors and the metric tensor. Coordinate systems and coordinate basis vectors. Reciprocal

coordinate basis. Change of basis: relation between coordinate basis vectors. Change of tensor components under change of coordinate system. Example: Inertial coordinates & bases in Minkowski space, Lorentz transformations as coordinate transformations, 10 L

UNIT 4

Calculus of Variations :Variational Principle: Euler's Equation. Application to Simple Problems (shape of a soap film, Fermat's Principle). Several Dependent Variables and Euler's Equations. Hamilton's Principle and the Euler-Lagrange equations of motion. Constrained Variations: Variations with constraints. Applications: motion of a simple pendulum, 8 L

Text book [TB]:

1. Mathematical Tools for Physics, James Nearing, Dover Publications, 2010
2. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, and F.E. Harris, Elsevier, 1970.

Reference books [RB]:

1. Mathematical Methods for Physicists & Engineers, K.F.Riley, M.P.Hobson, S.J.Bence, 3rd Ed, Cambridge University Press, 2006

1. Department offering the course	Physics
2. Course Code	PYF358
3. Course Title	MEDICAL PHYSICS
4. Credits (L:T:P:C)	4:0:0:4
5. Contact Hours (L:T:P)	4:0:0
6. Prerequisites (if any)	None
7. Course Basket	Discipline Specific Elective

COURSE SUMMARY:
The course starts with physics of body, various mechanics involved in body system, electrical signals and optics of the body. The course also covers diagnostic and therapeutic techniques, radiation physics and medical imaging.

Course Objective:
The objective of this course is to develop knowledge about the fundamental laws of physics behind the human body and the various instruments used in diagnosis.

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:
After completing this course the student will be able to:
learn abpout the physics behind various parts of human body
develop the knowledge of X-rays being used in diagnosis
learn the importance of radiation physics and interaction of radiation with matter
explore the role of physics in the mediacal imaging techniques
learn the basic principles of radio isotope imaging

CURRICULUM CONTENT

UNIT 1
PHYSICS OF THE BODY-I
Mechanics of the body: Muscles and the dynamics of body movement, Physics of body crashing. Energy household of the body: Energy balance in the body, Energy consumption of the body, Heat losses of the body, Pressure system of the body: Physics of breathing, Physics of cardiovascular system.
PHYSICS OF THE BODY-II
Acoustics of the body: Nature and characteristics of sound, Production of speech, Physics of the ear, Diagnostics with sound and ultrasound. Optical system of the body: Physics of the eye. Electrical system of the body: Physics of the nervous system, Electrical signals and information transfer. 12 L

UNIT 2
PHYSICS OF DIAGNOSTIC AND THERAPEUTIC SYSTEMS-I
X-RAYS: Electromagnetic spectrum, production of x-rays, x-ray spectra, Brehmsstrahlung, Characteristic x-ray, X-ray tube, Coolidge tube, x-ray tube design, tube cooling stationary mode. 7 L

UNIT 3
RADIATION PHYSICS: Radiation units, exposure, absorbed dose – units: rad, gray relative biological effectiveness, effective dose, inverse square law, interaction of radiation with matter, linear attenuation coefficient. Radiation Detectors, Thimble chamber, condenser chambers, Geiger counter, Scintillation counter, ionization chamber, Dosimeters , survey methods, area monitors, TLD and semiconductor detectors. 8 L

UNIT 4

MEDICAL IMAGING PHYSICS: X-ray diagnostics and imaging, Physics of nuclear magnetic resonance (NMR), NMR imaging, MRI Radiological imaging. Ultrasound imaging.
RADIATION AND RADIATION PROTECTION: Principles of radiation protection, protective materials-radiation effects – somatic, genetic stochastic & deterministic effect, Personal monitoring devices , TLD film badge, pocket dosimeter. 7 L

UNIT 5

PHYSICS OF DIAGNOSTIC AND THERAPEUTIC SYSTEMS-II

Diagnostic nuclear medicine: Radiopharmaceuticals for radioisotope imaging, Radioisotope imaging equipment, Single photon and positron emission tomography. Therapeutic nuclear medicine: Interaction between radiation and matter Dose and isodose in radiation treatment 5 L

Text book [TB]:

1. Medical Physics, J.R. Cameron and J.G.Skofronick, Wiley, 1978
2. Basic Radiological Physics, Dr. K. Thayalan, Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi, 2003
3. Physics of the human body, Irving P. Herman, Springer, 2007.

Reference books [RB]:

1. The Physics of Radiology-H E Johns and Cunningham.
2. The essential physics of Medical Imaging: Bushberg, Seibert, Leidholdt and Boone Lippincot, Second Edition, Williams and Wilkins, 2002.
3. Physics of Radiation Therapy, F M Khan, 3rd edition, Williams and Wilkins, 2003.

1. Department offering the course	Physics
2. Course Code	PYF359
3. Course Title	**Physics of Semiconductor Devices**
4. Credits (L:T:P:C)	3:1:0:4
5. Contact Hours (L:T:P)	3:1:0
6. Prerequisites (if any)	None
7. Course Basket	Discipline Specific Elective

COURSE SUMMARY:

This course covers the knowledge of the semiconductors devices. It is appropriate for physics students who are interested to learn about semiconductors from a physics point of view. The course will also cover some basics of semiconductor devices, particularly emphasising the physical principles on which they function

Course Objective:

The objective of this course is to acquire knowledge of semiconductor physics and discuss working and applications of basic devices, including p-n junctions, BJTs and FETs.

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

1. To explain the basic properties of semiconductors including the band gap, charge carrier concentration, doping and charge carrier injection/excitation.
2. To explain the working, design considerations and applications of various semiconducting devices including p-n junctions, BJTs and FETs.
3. To describe the working and design considerations for the various photonic devices like photodetectors, solar-cells and LEDs

CURRICULUM CONTENT

UNIT 1

Semiconductor, Bonds in Semiconductors, Energy band, Effect of temperatures on Semiconductor, Hole currents, Intrinsic & extrinsic semiconductor, carrier concentration and conductivity in intrinsic and extrinsic semiconductors and their temperature dependence, Energy bands in semiconductors. 10L

UNIT 2

p-n junction diode, Semiconductor diode, Crystal diode rectifiers, Half wave rectifiers, Efficiency of half wave rectifier, Full wave rectifier, Centre tap full wave rectifier, Ripple factor, Filter Circuits, Voltage stabilization, Zener diode, Zener diode as Voltage stabilizer.

10L

UNIT 3

Transistors, Transistors connections, Common base connection, Common emitter connection, common collector connection, Comparison of transistor connections, Transistor as an amplifier in CE arrangement.JEFT amplifying and switching, Pinch off and saturation, Gate control, I-V characteristics. MOSFET.

10L

UNIT 4

Photodiodes, photo detectors, solar cell, light emitting diodes, semiconductor lasers, light emitting materials, Radiative transition,. The transferred electron mechanism: The GUNN diode Emission spectra, Luminous efficiency and LED materials, Solar cell and photodetectors, Reverse saturation current in photodetector

8L

Text book [TB]:

1. Fundamentals of Semiconductor Devices by Joseph Lindmayer, Charles Y. Wrigly, Litton Educational Publishing Inc.
2. Semiconductor Electronics by A.K. Sharma, New Age International (P) Limited Publisher, New Delhi.

Reference books [RB]:

1. Physics of Semiconductor Devices by S.M.Sze, John Wily & Sons, New Delhi.

1. Department offering the course	Physics
2. Course Code	PYF366
3. Course Title	Classical Dynamics
4. Credits (L:T:P:C)	4:0:0:4
5. Contact Hours (L:T:P)	4:0:0
6. Prerequisites (if any)	None
7. Course Basket	Discipline Specific Elective

COURSE SUMMARY:

The course covers concepts of classical mechanics like Hamiltonian of a system applications of Lagrange equations to different systems, special theory of relativity, four vector, Maxwell equations in tensor form, electromagnetic radiation and its applications.

Course Objective:

The emphasis of the course is on giving the students first hand experience in solving intermediate and advanced level problems in classical mechanics, special theory of relativity and also impart the idea of radiation associated with movement of charges.

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

1. Have competence in understanding degrees of freedom of the system and develop equations of motion based on Lagrange's equation.
2. Interpret and associate canonical momenta with coordinates and work with Hamiltonian formulation.
3. Have insight in Special Theory of Relativity especially variation of various properties of the system .
4. Comprehend concepts of transformation of fields
5. Gain understanding of radiation applicable at fundamental levels.

CURRICULUM CONTENT

UNIT 1

Classical Mechanics of Point Particles: Generalised coordinates and velocities. Hamilton's Principle, Lagrangian and Euler-Lagrange equations. Applications to simple systems such as coupled oscillators. Canonical momenta & Hamiltonian. Hamilton's equations of motion. Applications: Hamiltonian for a harmonic oscillator, particle in a central force field. Poisson brackets. Canonical transformations.

14 L

UNIT 2

Special Theory of Relativity: Postulates of Special Theory of Relativity. Lorentz Transformations. Minkowski space. The invariant interval, light cone and world lines. Space-time diagrams. Time-dilation, length contraction & twin paradox. Four-vectors: space-like, time-like & light-like. Four-velocity and acceleration. Metric and alternating tensors. Four-momentum and energy-momentum relation. Doppler effect from a fourvector perspective. Concept of four-force. Conservation of four-momentum. Relativistic kinematics. Application to two-body decay of an unstable particle. The Electromagnetic field tensor and its transformation under Lorentz transformations: relation to known transformation properties of E and B. Electric and magnetic fields due to a uniformly moving charge. Equation of motion of charged particle & Maxwell's equations in tensor form. Motion of charged particles in external electric and magnetic fields.

15 L

UNIT 3

Electromagnetic radiation: Review of retarded potentials. Potentials due to a moving charge: Lienard Wiechert potentials. Electric & Magnetic fields due to a moving charge: Power radiated, Larmor's formula and its relativistic generalisation. 10 L

Text book [TB]:

1. Classical Mechanics, H.Goldstein, C.P. Poole, J.L. Safko, 3rd Edn.,Pearson Education, 2002.
2. Mechanics, L. D. Landau and E. M. Lifshitz, Pergamon, 1976.

Reference books [RB]:

1. Introduction to Electrodynamics, D.J. Griffiths, Pearson Education, 2012

1. Department offering the course	Physics
2. Course Code	PYF367
3. Course Title	Atmospheric Physics
4. Credits (L:T:P:C)	4:0:0:4
5. Contact Hours (L:T:P)	4:0:0
6. Prerequisites (if any)	None
7. Course Basket	Discipline Specific Elective

COURSE SUMMARY:

The course develops a strong base on general features of Earth's atmosphere, atmospheric dynamics, atmospheric waves, atmospheric aerosols, radar and Lidar.

Course Objective:

The main objective of this course is to provide the detailed information of meteorology to the students.

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

1. To be able to understand general features of earth's atmosphere.

2. Enable to aciqure the knowledge of atmospheric dynamics.

3. Knowledge and understanding of atmospheric waves.
4. Understanding the atmospheric Radar and Lidar.
5. To acquire the knowledge of the atmospheric aerosols.

CURRICULUM CONTENT

UNIT 1

General features of Earth's atmosphere: Thermal structure of the Earth's Atmosphere, Ionosphere, Composition of atmosphere, Hydrostatic equation, Atmospheric Thermodynamics, Greenhouse effect and effective temperature of Earth, Local winds, monsoons, fogs, clouds, precipitation, Atmospheric boundary layer, Sea breeze and land breeze. Instruments for meteorological observations, including RS/RW, meteorological processes and different systems, fronts, Cyclones and anticyclones, thunderstorms. 8 L

UNIT 2

Atmospheric Dynamics: Scale analysis, Fundamental forces, Basic conservation laws, The Vectorial form of the momentum equation in rotating coordinate system, scale analysis of equation of motion, Applications of the basic equations, Circulations and vorticity, Atmospheric oscillations, Mesoscale circulations, The general circulations, Tropical dynamics. 8 L

UNIT 3

Atmospheric Waves: Surface water waves, wave dispersion, acoustic waves, buoyancy waves, propagation of atmospheric gravity waves (AGWs) in a nonhomogeneous medium, Lamb wave, Rossby waves and its propagation in three dimensions and in sheared flow, wave absorption, non-linear consideration 7 L

UNIT 4

Atmospheric Radar and Lidar: Radar equation and return signal, Signal processing and detection, Various type of atmospheric radars, Application of radars to study atmospheric phenomena, Lidar and its applications, Application of Lidar to study atmospheric phenomenon. Data analysis tools and techniques. 8 L

UNIT 5

Atmospheric Aerosols: Spectral distribution of the solar radiation, Classification and properties of aerosols, Production and removal mechanisms, Concentrations and size distribution, Radiative and health effects, Observational techniques for aerosols, Absorption and scattering of solar radiation,

Rayleigh scattering and Mie scattering, Bouguert-Lambert law, Principles of radiometry, Optical phenomena in atmosphere, Aerosol studies using Lidars. 8 L

Text book [TB]:

1. Fundamental of Atmospheric Physics, Murry L Salby, Vol 61 Academic Press, 1996
2. An Introduction to dynamic meteorology, James R Holton; Academic Press, 2004

Reference books [RB]:

1. Radar for meteorological and atmospheric observations, S Fukao and K Hamazu, Springer Japan, 2014

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	Physics
2. Course Code	PYF368
3. Course Title	Introduction to Astronomy and Astrophysics
4. Credits (L:T:P:C)	4:0:0:4
5. Contact Hours (L:T:P)	4:0:0
6. Prerequisites (if any)	None
7. Course Basket	Discipline Specific Elective

COURSE SUMMARY:

This course covers the basic knowledge of the universe. The aim of this course is to aware students about the stars and planets and astronomy and astrophysics.

COURSE OBJECTIVE:

The objective of this course is to introduce basis astronomical principles in the study of planets, stars, galaxies and wave detectors. Also it covers a survey of modern astronomy basics from an observer's perspective.

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

1. To acquire knowledge of the expanse of the universe and the nature of the planets, stars and galaxies.
2. To evaluate the results of this analysis and interpret the nature of the solar system, variety of stars and galaxies.
3. To be able to identify and illustrate basic concepts and terminology used in astrophysics.
4. Create new observational programs or data analysis and interpretation projects in astronomy.

CURRICULUM CONTENT

UNIT 1

The Sun, The structure of solar system, The physical processes in the solar system, Formation of planetary systems: The Nebular hypothesis, the tidal hypothesis, The stellar system: The brightness of the stars, effective temperatures of stars, Masses and radii of stars: Binary stars, search for extra-solar planets, Comets, Asteroids, Meteorites.

12L

UNIT 2

The microwave background radiation, The sun, The stars, Neutron stars and black holes, supernovae, Galaxies: Types of galaxies; spirals, elliptical and irregulars. Earth in space.

8L

UNIT 3

Variable stars and Asteroseismology: Photometry of variable stars, differential photometry, extinction coefficients, classes of variable stars, period-mean density relationship, Classical Cepheids as distance indicators, pulsation mechanisms.

10L

UNIT 4

Telescope: basic optical telescope, optical telescope, telescopes for gamma ray, x-ray, UV, IR and radio astronomy, Astronomy-detectors and observatories. Gravitational wave detectors.

10L

Text book [TB]:

1. Introduction to Stellar Astrophysics, Volume 1, Basic stellar observations and data, By Erika Bohm-Vitense, Cambridge University Press
2. An Introduction to Modern Astrophysics, Second Edition, By Carroll B.W., Ostlie D.A., Pearson Addison Wesley.
3. "Astrophysics for Physicists" by Arnab Rai Choudhuri, Cambridge University Press, 2010.

Reference books [RB]:

1. Fundamentals of Solar Astronomy by A. Bhatnagar & W.C. Livingston (World Scientific, 2005).
2. Universe by R. A. Freedman & W. J. Kaufmann (W.H.Freeman & Co., 2008).

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	Physics
2. Course Code	PYF369
3. Course Title	Earth Science
4. Credits (L:T:P:C)	4:0:0:4
5. Contact Hours (L:T:P)	4:0:0
6. Prerequisites (if any)	None
7. Course Basket	Discipline Specific Elective

COURSE SUMMARY:

The course starts with the study of origin of universe, milky way, solar system and develops fundamental knowledge of structure and shape of planet earth, interior of earth, rivers, biosphere, chemical composition, dynamical processes like origin of oceans, ocean current, origin of life on earth, and the factors disturbing earth's atmosphere.

Course Objective:

The main goal of this course is to equip students with understanding of earth's science and its important aspects in everyday life.

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

1. To be able to understand earth, universe and its general characteristic.
2. Enable to aciqure the knowledge of earth's structure.
3. Knowledge and understanding of dynamical processes and volcanoes.
4. Understanding the earth's evolution.
5. To acquire the knowledge of the earth's biodiversity.

CURRICULUM CONTENT

UNIT 1

The Earth and the Universe: Origin of universe, creation of elements and earth. A Holistic understanding of our dynamic planet through Astronomy, Geology, Meteorology and Oceanography. Introduction to various branches of Earth Sciences.General characteristics and origin of the Universe. The Milky Way galaxy, solar system, Earth's orbit and spin, the Moon's orbit and spin. The terrestrial and Jovian planets. Meteorites & Asteroids. Earth in the Solar system, origin, size, shape, mass, density, rotational and revolution parameters and its age. Energy and particle fluxes incident on the Earth. The Cosmic Microwave Background. 9 L

UNIT 2

Structure: The Solid Earth: Mass, dimensions, shape and topography, internal structure, magnetic field, geothermal energy. How do we learn about Earth's interior? The Hydrosphere: The oceans, their extent, depth, volume, chemical composition. River systems. The Atmosphere: variation of temperature, density and composition with altitude, clouds. The Cryosphere: Polar caps and ice sheets. Mountain glaciers. The Biosphere: Plants and animals. Chemical composition, mass. Marine and land organisms. 6 L

UNIT 3

Dynamical Processes: The Solid Earth: Origin of the magnetic field. Source of geothermal energy. Convection in Earth's core and production of its magnetic field. Mechanical layering of the Earth. Introduction to geophysical methods of earth investigations. Concept of plate tectonics; sea-floor spreading and continental drift. Geodynamic elements of Earth: Mid Oceanic Ridges, trenches,

transform faults and island arcs. Origin of oceans, continents, mountains and rift valleys. Earthquake and earthquake belts. Volcanoes: types products and distribution. The Hydrosphere: Ocean circulations. Oceanic current system and effect of coriolis forces. Concepts of eustasy, tend – air-sea interaction; wave erosion and beach processes. Tides. Tsunamis. The Atmosphere: Atmospheric circulation. Weather and climatic changes. Earth's heat budget. Cyclones.Climate: Earth's temperature and greenhouse effect, Paleoclimate and recent climate changes, The Indian monsoon system. Biosphere: Water cycle, Carbon cycle, Nitrogen cycle, Phosphorous cycle. The role of cycles in maintaining a steady state. 8 L

UNIT 4

Evolution: Nature of stratigraphic records, Standard stratigraphic time scale and introduction to the concept of time in geological studies. Introduction to geochronological methods in their application in geological studies. History of development in concepts of uniformitarianism, catastrophism and neptunism. Law of superposition and faunal succession. Introduction to the geology and geomorphology of Indian subcontinent.

1. Time line of major geological and biological events.
2. Origin of life on Earth.
3. Role of the biosphere in shaping the environment.
4. Future of evolution of the Earth and solar system: Death of the Earth. 8 L

UNIT 5

Disturbing the Earth – Contemporary dilemmas , Human population growth, Atmosphere: Green house gas emissions, climate change, air pollution, Hydrosphere: Fresh water depletion, Geosphere: Chemical effluents, nuclear waste, Biosphere: Biodiversity loss. Deforestation. Robustness and fragility of ecosystems. 8 L

Text book [TB]:

1. Planetary Surface Processes, H. Jay Melosh, Cambridge University Press, 2011.
2. Consider a Spherical Cow: A course in environmental problem solving, John Harte.University Science Books

Reference books [RB]:

1. Holme's Principles of Physical Geology. Chapman & Hall, 1992.
2. Planet Earth, Cosmology, Geology and the Evolution of Life and Environment, Emiliani C, Cambridge University Press, 1992.

1. Department offering the course	Physics
2. Course Code	PYF376
3. Course Title	Embedded System: Introduction To Microcontrollers
4. Credits (L:T:P:C)	3:0:2:4
5. Contact Hours (L:T:P)	3:0:2
6. Prerequisites (if any)	None
7. Course Basket	Discipline Specific Elective

COURSE SUMMARY:

Course Structure & Syllabus of B.Sc (Hons) Physics

Applicable for Batch: 2021-24

COURSE OBJECTIVE: This course aims to discuss the major components that constitute an embedded system, implement small programs to solve well-defined problems on an embedded platform, develop familiarity with tools used to develop in an embedded environment.

COURSE OUTCOME:

On successful completion of the course, students will be able to achieve the following:

1. Understand what is a microcontroller, microcomputer, embedded system.
2. Understand different components of a micro-controller and their interactions.
3. Become familiar with programming environment used to develop embedded systems
4. Understand key concepts of embedded systems like IO, timers, interrupts, interaction with peripheral devices
5. Learn debugging techniques for an embedded system

CURRICULUM CONTENT

Unit-I

Embedded system introduction: Introduction to embedded systems and general purpose computer systems, architecture of embedded system, classifications, applications and purpose of embedded systems, challenges & design issues in embedded systems, operational and non-operational quality attributes of embedded systems, elemental description of embedded processors and microcontrollers.

Review of microprocessors: Organization of Microprocessor based system, 8085µp pin diagram and architecture, concept of data bus and address bus, 8085 programming model, instruction classification, subroutines, stacks and its implementation, delay subroutines, hardware and software interrupts. 10L

Unit-II

8051 microcontroller: Introduction and block diagram of 8051 microcontroller, architecture of 8051, overview of 8051 family, 8051 assembly language programming, Program Counter and ROM memory map, Data types and directives, Flag bits and Program Status Word (PSW) register, Jump, loop and call instructions.

8051 I/O port programming: Introduction of I/O port programming, pin out diagram of 8051 microcontroller, I/O port pins description & their functions, I/O port programming in 8051 (using assembly language), I/O programming: Bit manipulation. 8L

Unit - III

Programming: 8051 addressing modes and accessing memory using various addressing modes, assembly language instructions using each addressing mode, arithmetic and logic instructions, 8051 programming in C: for time delay & I/O operations and manipulation, for arithmetic and logic operations, for ASCII and BCD conversions. 7L

Unit - IV

Timer and counter programming: Programming 8051 timers, counter programming.

Serial port programming with and without interrupt: Introduction to 8051 interrupts, programming timer interrupts, programming external hardware interrupts and serial communication interrupt, interrupt priority in the 8051. 7L

Unit - V

Interfacing 8051 microcontroller to peripherals: Parallel and serial ADC, DAC interfacing, LCD interfacing. 7L

TEXT BOOKS

1. Embedded Systems: Architecture, Programming & Design, R.Kamal, 2008,Tata McGraw Hill

2. The 8051 Microcontroller and Embedded Systems Using Assembly and C, M.A. Mazidi, J.G. Mazidi, and R.D. McKinlay, 2nd Ed., 2014, Pearson Education India.

REFERENCE BOOKS

1. Embedded microcomputor system: Real time interfacing, J.W.Valvano, 2011, Cengage learning
2. Microcontrollers in practice, I. Susnea and M. Mitescu, 2011, Springer

1. Department offering the course	Physics
2. Course Code	PYF377
3. Course Title	Computational Physics – II
4. Credits (L:T:P:C)	3:1:0:4
5. Contact Hours (L:T:P)	3:1:0
6. Prerequisites (if any)	None
7. Course Basket	Discipline Specific Elective

COURSE SUMMARY:

This course included following numerical methods: Bisection method, Regula-Falsi method, Iterative method, Newton Raphson method Jacobi method, Gauss-Seidal, Quadrature formulae, Simpson's 1/3 and 3/8 rule, Euler's method and its variants, Runge-Kutta.Application to physics problems.

Course Objective:

To introduce numerical methods for the basic problems of numerical analysis

To gain experience in the implementation of numerical methods using a MATLAB.

To apply numerical method for solving physics problems.

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

1. Apply different numerical methods to find roots of equations.
2. Evaluate differentiation and integration numerically.
3. Use Matlab tools for the implementation and application of numerical methods

CURRICULUM CONTENT

UNIT 1

Bisection method, Regula-Falsi method, Iterative method, Newton Raphson method for solving transcendental equations, Built in functions for solving transcendental Equations. Jacobi method, Gauss-Seidal method for solving system of equations, their comparative study using various stopping criterion. Built in functions for solving system of equations. Programming of above methods in MATLAB. 8L

UNIT 2

Quadrature formulae, Programs for trapezoidal rule, Simpson's 1/3 and 3/8 rule and their comparison. Using builtin functions for numerical integration. Few builtin functions for interpolation, and curve fitting. 6L

UNIT 3

Solving various types of differential equations, Euler's method and its variants, Runge-Kuttamethods for solving IVPs, programming in MATLAB, use of builtin functions for solving IVPs, code for solving system of IVPs. 8L

UNIT 4

Application to physics problems: Solution of wave equation and heat equation using variableseparable method, and their simulation in MATLAB, problems related to Simple Harmonic Motion, L-C-Rcircuits, decay problems, planetary motion. 10L

Text book [TB]:

Applied Numerical Methods with Matlab for Engineers and Scientists. Steven Chapra, McGraw-Hill Education; 3 edition, 2011.

Reference books [RB]:

1. **MATLAB: An introduction with applications**. Amos Gilat, John Wiley & Sons; 5th edition, 2014.
2. **Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers**. RudraPratap,Oxford; Edition edition, 2010.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	Physics
2. Course Code	PYF378
3. Course Title	Nano Materials And Applications
4. Credits (L:T:P:C)	4:0:0:4
5. Contact Hours (L:T:P)	4:0:0
6. Prerequisites (if any)	None
7. Course Basket	Discipline Specific Elective

COURSE SUMMARY:

The course develops a strong background of nanoscale materials, concept of quantum confinement, synthesis and characterization techniques for nanoscale materials, optical properties and applications.

Course Objective:

This course introduces the fundamentals of nano-scale science and technology. Current and future applications of nanostructured materials will be reviewed with respect to their impact in commercial products and technologies.

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

1. Explain the fundamental principles of nanotechnology and their application to biomedical engineering.
2. Apply engineering and physics concepts to the nano-scale and non-continuum domain.
3. Identify and compare state-of-the-art nanofabrication methods
4. Explore the characterization techniques for analysis of different properties of nanomaterials
5. Study the applications of nanomaterials in different fields

CURRICULUM CONTENT

UNIT 1

NANOSCALE SYSTEMS: Length scales in physics, Nanostructures: 1D, 2D and 3D nanostructures (nanodots, thin films, nanowires, nanorods), Band structure and density of states of materials at nanoscale, Size Effects in nano systems, Quantum confinement: Applications of Schrodinger equation- Infinite potential well, potential step, potential box, quantum confinement of carriers in 3D, 2D, 1D nanostructures and its consequences. 8 L

UNIT 2

SYNTHESIS OF NANOSTRUCTURE MATERIALS: Top down and Bottom up approach, Photolithography. Ball milling. Gas phase condensation. Vacuum deposition. Physical vapor deposition (PVD): Thermal evaporation, E-beam evaporation, Pulsed Laser deposition. Chemical vapor deposition (CVD). Sol-Gel. Electro deposition. Spray pyrolysis. Hydrothermal synthesis. Preparation through colloidal methods. MBE growth of quantum dots. 8 L

UNIT 3

CHARACTERIZATION: X-Ray Diffraction. Optical Microscopy. Scanning Electron Microscopy. Transmission Electron Microscopy. Atomic Force Microscopy. Scanning Tunneling Microscopy. 7 L

UNIT 4

OPTICAL PROPERTIES: Coulomb interaction in nanostructures. Concept of dielectric constant for nanostructures and charging of nanostructure. Quasi-particles and excitons. Excitons in direct and indirect band gap semiconductor nanocrystals. Quantitative treatment of quasi-particles and

excitons, charging effects. Radiative processes: General formalization-absorption, emission and luminescence. Optical properties of heterostrctures and nanostructures. 8 L

UNIT 5

APPLICATIONS: Applications of nanoparticles, quantum dots, nanowires and thin films for photonic devices (LED, solar cells). Single electron devices (no derivation). CNT based transistors. Nanomaterial Devices: Quantum dots heterostructure lasers, optical switching and optical data storage. Magnetic quantum well; magnetic dots - magnetic data storage. Micro Electromechanical Systems (MEMS), Nano Electromechanical Systems (NEMS). 8 L

Text book [TB]:

1. Nanotechnology: Principles & Practices, S.K. Kulkarni, 3rd edition, Capital Publishing Company, 2014
2. Introduction to Nanoscience and Technology, K.K. Chattopadhyay and A. N. Banerjee, PHI Learning Private Limited, 2009.

Reference books [RB]:

1. Textbook of Nanoscience and Nanotechnology, Universities Press (India) Pvt Limited, 2014

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	Physics
2. Course Code	PYF379
3. Course Title	Introduction to Quantum Computation
4. Credits (L:T:P:C)	4:0:0:4
5. Contact Hours (L:T:P)	4:0:0
6. Prerequisites (if any)	None
7. Course Basket	Discipline Specific Elective

COURSE SUMMARY:
This course covers the knowledge of the mathematics and computer science. The aim of this course is to do computation using the quantum mechanical effects.

Course Objective:
The objective of this course is to provide the students an introduction to quantum computation. Much of the background material related to the algebra of complex vector spaces and quantum mechanics is covered within the course.

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

1. To acquire knowledge of the computational physics.
2. To evaluate the results and analysis for the theoretical research in future.
3. To be able to identify and illustrate basic concepts and terminology used in computational physics.
4. To have basic knowledge of linear algebra and computing physics.

CURRICULUM CONTENT

UNIT 1

Introduction to Quantum Computation**:** Quantum bits, Bloch sphere representation of a qubit, multiple qubits 6L

UNIT 2

Background Mathematics and Physics: Hilbert space, Probabilities and measurements, entanglement, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis

12L

UNIT 3

Quantum Circuits: single qubit gates, multiple qubit gates, design of quantum Circuits 5L

UNIT 4

Noise and error correction: Quantum Operations and Krauss Operators, The Depolarization Channel, The Bit Flip and Phase Flip Channels Amplitude Damping Phase Damping, Quantum Error Correction. 10L

UNIT 5

Quantum Information and Cryptography: Comparison between classical and quantum information theory. Bell states. Quantum teleportation. Quantum Cryptography, no cloning theorem, quantum algorithm. 7L

Text book [TB]:

1. Nielson M.A., Quantum Computation and Quantum Information, Cambridge University Press, 2002.
2. 2 . Benenti G., Casati G. and Strini G., **Principles of Quantum Computation and Information**, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific, 2004.

Reference books [RB]:

1. Course Information for Physics 219/computer science 219 Quantum Computation

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

Generic Elective (Minimum 16 Credits to be taken)

1.	Department offering the course	Computer Science and Engineering
2.	Course Code	CSF101
3.	Course Title	Programming for problem solving
4.	Credits (L:T:P:C)	3:0:2:4
5.	Contact Hours (L:T:P)	3:0:2
6.	Prerequisites (if any)	None
7.	Course Basket	Generic Elective

COURSE SUMMARY:

This course contains the fundamental concepts about the computer hardware and intends to provide to students about the knowledge of C language.

Course objective:

The objective of the course is to make the students to understand the key hardware components in a modern computer system and as to how the software is mapped to the hardware. The student shall also be able to learn make the computer programs using C language by exploring the various features of C.

COURSE OUTCOMES:

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

1. To formulate simple algorithms for arithmetic and logical problems.
2. To implement conditional branching, iteration and recursion.
3. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
4. To use arrays, pointers and structures to formulate algorithms and programs.
5. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems

Curriculum Content

UNIT 1: Introduction to Computer, Programming & algorithms (8 L)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples, From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

UNIT 2: Arithmetic Expression, and Conditional statements, Loops, Expression: (7 L)

Arithmetic, Logical, Relational expressions and precedence.

Loops & Branching: Writing and evaluation of conditionals and consequent branching, Iteration and loops.

UNIT 3: Arrays & Functions (7 L)

Arrays: Arrays (1-D, 2-D), Character arrays and Strings.

Functions: functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference.

Searching & Sorting: Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

UNIT 4: Recursion and Structure (8 L)

Recursion: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc.

Structure: Structures, Defining structures and Array of Structures.

UNIT 5: Pointers & File handling (7 L)

Pointers: Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list.

File handling: different modes of opening a file in C, reading, writing from files.

TEXT BOOKS

1. Byron Gottfried, "Schaum's Outline of Programming with C", 2nd edition 2006 McGraw-Hill.

2. E. Balaguruswamy, "Programming in ANSI C", 8th Edition 2019, McGraw-Hill Eduaction India.

References

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", 2nd edition 1988, Prentice Hall of India.

Teaching and learning strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

List of experiments:

S.NO.	EXPERIMENT NAME
1	Familiarization with programming environment.
2	Programming for Simple computational problems using arithmetic expressions.
3	Programming for Problems involving if-then-else structures.
4	Programming for Iterative problems e.g., sum of series.
5	Programming for 1-D Array manipulation.
6	Programming for Matrix problems, String operations.
7	Programming for Simple functions
8	Programming for Recursive functions.
9	Programming for Pointers and structures.
10	Programming for File operations
11	Programming for solving Numerical methods problems

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1.	Department offering the course	Computer Science and Engineering
2.	Course Code	CSF102
3.	Course Title	Data Structures
4.	Credits (L:T:P:C)	3:0:2:4
5.	Contact Hours (L:T:P)	3:0:2
6.	Prerequisites (if any)	Programming for problem solving
7.	Course Basket	Generic Elective

COURSE SUMMARY

The course is a foundation level course and requires the knowledge of the C programming language. The course outlines the detailed architecture and implementation of basic data structures such as Stacks, Queues, Linked Lists, Trees, and Graphs. It also covers the time and space complexity analysis of different searching and sorting techniques. Some of the searching methods include Linear Search, Binary Search, and sorting mechanism includes Bubble sort, Insertion sort, Selection sort, Quick sort, Merge sort, and Heap Sort. The course also incorporates different hashing techniques, designing hash functions, hash table implementation, and collision resolution technique.

COURSE OBJECTIVES

The main objective of this course is to introduce the concept of data structure, how to choose a particular data structure, and how the choice of a data structure impacts the performance of programs. The other objective may include, how to select the appropriate data structure model specific to some application. Solve problems using data structures like Stacks, Queues, Linked Lists, Trees, Graphs, and writing programs for these solutions using C code. Introduce the concept of algorithm writing, analyzing algorithms, converting pseudocode to appropriate C code, and showing how one solution is better than others by analyzing their computational complexities.

COURSE OUTCOMES

On successful completion of the course, students will be able to achieve the following:

1. The student will develop an ability to read, write, and analyze the time and space complexity of any algorithms.
2. Able to describe the properties, behaviour, and implementation of basic data structures like Stacks, Queues, Linked List, Trees, and Graphs.
3. Able to convert pseudocode to its appropriate C code implementation.
4. Able to compare different searching and sorting techniques in terms of their memory usage and time consumption.
5. Able to design and implement different hash functions, analyze the collision effect, and hash table implementations.

CURRICULUM CONTENT

Unit 1: Introduction to Algorithms & Data Structure (8 L)

Introduction: Data types, Abstraction, Abstract Data Type (ADT), Concept of data structure, Types

of data structures, Operations on Data Structures, Introduction to Algorithms, Writing Pseudocodes, Algorithm analysis, Complexity of algorithms and Time space trade-off, Searching: Linear and Binary Search Techniques and their complexity analysis.

Unit 2: Arrays, Stacks, and Queues (7 L)

Arrays: Introduction to Array, Applications of Array, Operations on Arrays: Traverse, Insert, Delete etc. Stacks: Introduction to Stacks, Array representation of Stack, Operations on Stack: Push, Pop, etc. Applications of Stacks: Infix and Postfix Conversion, Evaluations of Infix and Postfix expressions. Queue: Introduction to Queue, Array representation and implementation of queues, Operations of Queue, Applications of Queue, Types of Queue: Circular Queue, Priority Queue, Double ended Queue. Operations on each type of Queue and their Applications.

Unit 3: Linked Lists and Trees (8 L)

Linked Lists: Introduction to Dynamic Memory Allocation, Representation and Implementation of Single, Double, and Circular Linked Lists, Operations on Linked List: Insert, Delete, Traverse etc. Applications of Linked List, Linked List representation of Stack and Queue. Trees: Basic Tree terminologies, Types of Trees: Binary Tree, Binary Search Tree (BST), AVL Tree, B-Tree, and Heap. Representation and Implementations of different types of trees, Tree Traversal algorithms, Operation on trees: Insert, Delete, etc., Applications of Tress.

Unit4: Graphs (7 L)

Graphs: Introduction to Graph and their Terminologies, Types of Graph, Representations of Graph, Graph traversal algorithms, Topological Sorting, Minimum Spanning Tree, Shortest Path Algorithms: Single Source Shortest Path like Bellman-Ford, Dijkstra and All Pair Shortest Path like Floyd-Warshall.

Unit- 5: Sorting &Hashing: (9L)

Sorting Algorithms and their Analysis: Selection Sort, Bubble sort, Insertion sort, Quick sort, Merge sort, Heap Sort. Performance Analysis and Comparison of all sorting techniques. Hashing: Hash Functions and its type, Hash Table construction, Collision Resolution, Universal Addressing, Open Hashing.

TEXTBOOK(S)

1. Aaron M. Tenenbaum, YedidyahLangsam, Moshe J. Augenstein, Data Structures using C Pearson.1st Edition.2019
2. Schaum's outline series ,Data structures with C, McGraw Hill Education; 1st edition (July 2017)

REFERENCE BOOKS

1. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication,2nd Edition. 2008.
2. Robert Kruse, Data Structures and Program Design in C PHI.2nd Edition.2006.
3. Willam J. Collins, Data Structure and the Standard Template library –2003, T.M.H.1st Edition.
4. Kyle Loudon, Mastering Algorithms with C, O'Reily Publication, 1st Edition, 1999

TEACHING AND LEARNING STRATEGY

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

List of Experiments

S.NO.	EXPERIMENT NAME
1	Program in C for the implementation of Array for various operations.
2	Program in C for the creation of Stack for its various operation implementation.
3	Program in C for the creation of Queue for its various operation implementation.
4	Program in C for the creation of Link list for its various operation implementation.
5	Program in C for the creation of Circular Link list for its various operation implementation.
6	Program in C for the creation of Doubly Link list for its various operation implementation.
7	Program in C for the creation of Binary Search Tree for its various operation implementation.
8	Program in C for the Implementation of sorting Algorithms.
9	Program in C for the Implementation of basic Graph Algorithms.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1.	Department offering the course	Computer Science and Engineering
2.	Course Code	CSF302
3.	Course Title	Design and Analysis of Algorithms
4.	Credits (L:T:P:C)	3:0:2:4
5.	Contact Hours (L:T:P)	3:0:2
6.	Prerequisites (if any)	Data Structures
7.	Course Basket	Generic Elective

COURSE SUMMARY

Comprehensive introduction to the study of computer algorithms with its analysis (time and space complexity). Study of various techniques (Divide & Conquer, Greedy, Dynamic Programming, Backtracking, and Branch & Bound) to design an algorithm. Introduction of the problems that comes under category of P and NP.

COURSE OBJECTIVES

This course aims to provide the knowledge and understanding the complexity issues of algorithms

1. To introduce algorithms analysis and design techniques
2. To understand and design of algorithms used for searching, sorting, indexing operation.

COURSE OUTCOMES

1. Analyzing complexity issues of algorithms
2. Ability in using the appropriate algorithm for searching, sorting, indexing operations
3. Designing of new algorithms
4. Student will be able to learn NP Class problems.

CURRICULUM CONTENT

Unit-I (6 L)

Introduction: Algorithms, Performance Analysis: Space and Time Complexity, Asymptotic Notations- Big Oh, Omega, theta notations, finding complexity of the algorithm, Sorting: Insertion sort, Bubble sort, selection sort, count sort.

Unit –II (8 L)

Recurrence relation and its solution (substitution, recurrence tree and master method).

Divide and Conquer: General method, binary search, quick sort, merge sort, heap sort

Unit –III (8 L)

Greedy Method: General method, Activity Selection, job scheduling with deadlines, fractional knapsack problem, Minimum cost spanning tree: Kruskal's and Prim's, single source shortest path, Huffman tree.

Unit – IV (9 L)

Dynamic Programming: General Method, 0-1 Knapsack, Matrix chain multiplication, longest subsequence, all pair shortest paths,

Backtracking- Travelling Salesman Problem, Graph Coloring, n-Queen Problem, Hamiltonian Cycles and Sum of subsets.

Unit –V (6 L)

Branch and Bound: Travelling Salesman Problem

NP-Hard and NP-Complete problems: Basic Concepts, non-deterministic algorithms, NP-Hard and NP-Complete classes.

TEXT BOOKS:

1. Ellis Horowitz, SatrajSahni and Rajasekharam, Fundamentals of Computer Algorithms, Universities Press; Second edition (2008).

2. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, "Introduction to Algorithms", MIT Press; 3rd edition (2009).

3. Anany Levitin, "Introduction to the Design and Analysis of Algorithm", Pearson Education India; 2nd edition (2008).

4. M.T.Goodrich and R.Tomassia, Algorithm Design: Foundations, Analysis and Internet examples, John Wiley & Sons; 1st edition (2001)

REFERENCE BOOKS:

1. R.C.T.Lee, S.S.Tseng, R.C.Chang and T.Tsai, Introduction to Design and Analysis of Algorithms A strategic approach, McGraw-Hill Education (Asia) ,2005

2. Aho, Ullman and Hopcroft ,Design and Analysis of algorithms, Pearson Education India; 1st edition 2002

TEACHING AND LEARNING STRATEGY

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

List of Experiments

S.NO.	EXPERIMENT NAME
1	Program in C to Implement Insertion sort, selection sort
2	Program in C to Implement Quick Sort
3	Program in C to Implement Merge Sort
4	Program in C to Implement Binary Searching, Heap sort
5	Program in C to Implement Activity Selection problem
6	Program in C to Implement job scheduling with deadlines
7	Program in C to Implement fractional knapsack problem
8	Program in C to Implement single source shortest path (Dijkstra Algorithm)
9	Program in C to Implement 0-1 Knapsack problem using Dynamic Programming
10	Program in C to Implement all pair shortest path

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1.	Department offering the course	CSE
2.	Course Code	CSF304
3.	Course Title	Artificial Intelligence
4.	Credits (L:T:P:C)	3:0:2:4
5.	Contact Hours (L:T:P)	3:0:2
6.	Prerequisites (if any)	Design and Analysis of Algorithms
7.	Course Basket	Generic Elective

COURSE SUMMARY

The course will start with a brief introduction to artificial Intelligence. This course includes basic AI search techniques like A*, BFS, DFS. Introduction to Prolog is also important part of the content. Knowledge Representation, Reasoning Planning and Learning being requirement for development of expert system is also part of this course.

COURSE OBJECTIVES

The course is proposed to teach concepts of Artificial Intelligence. The subject will provide the foundations for AI problem solving techniques and knowledge representation formalisms.

COURSE OUTCOMES

On successful completion of the course, students will be able to achieve the following:

1. Ability to identify and formulate appropriate AI methods for solving a problem.
2. Ability to implement AI algorithms.
3. Ability to compare different AI algorithms in terms of design issues, computational complexity, and assumptions.
4. Student will be able to use the concepts of AI for real world problem solving.
5. Visualize the basic use of AI algorithms and their implementations in laboratory.

CURRICULUM CONTENT

Unit I (8 L)

Introduction- Definitions, Intelligent Agents, Problem solving and Search- Uninformed Search, Informed Search, MiniMax Search, Constraint Satisfaction Problem, A*, Best Search, DFS, BFS.

Unit II (7 L)

Prolog-Introduction to Prolog, Syntax and Meanings of Prolog Programs, Operators and Arithmetic, Prolog for Artificial Intelligence.

Unit III (7 L)

Knowledge Representation- Introduction, Approaches and Issues in Knowledge Representation, Propositional Logic and Inference, First-Order Logic and Inference, Unification and Resolution, Expert Systems.

Unit IV (8 L)

Reasoning- Introduction, Types of Reasoning, Probabilistic Reasoning, Probabilistic Graphical Models, Certainty factors and Rule Based Systems, Introduction to Fuzzy Reasoning.

Unit V (7 L)

Planning and Learning- Introduction to Planning, Types-Conditional, Continuous, Multi-Agent. Introduction to Learning, Categories of Learning, Inductive Learning, Supervised and Unsupervised & Reinforcement Learning, Basic Introduction to Neural Net Learning.

TEXT BOOKS:

1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education India; 3rd edition (2015).
2. Elaine Rich, Kevin Knight and Shivashankar B.Nair, "Artificial Intelligence", McGraw Hill Education; 3rd edition (2017).
3. Nils J. Nilsson, "Artificial Intelligence - A New Synthesis", Morgan Kaufmann Publishers, Inc.; 1st edition (1998).

REFERENCE BOOKS:

1. Ivan Bratko, "Prolog Programming for Artificial Intelligence", Addison Wesley; 4th edition (August 2011).
2. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", Prentice-Hall (1990)

TEACHING AND LEARNING STRATEGY

The teaching of students will be conducted through power point lectures, tutorials, short classroom exercises aimed at solving real life problems. The lecture material (pdf/ppts, assignments, labs, etc.) will be availed to the students in Moodle (lms.dituniversitu.edu.in) to enable them have appropriate reading.

List of Experiments

S. No.	EXPERIMENT NAME
1	Introduction to PROLOG programming, PROLOG platform. "Hello World" program.
2	Defining Clauses and Predicates, Variables, Anonymous Variables.
3	Arithmetic Operators, Arithmetic Functions and Logical Operators (NOT, conjunction disjunction).
4	Binding Variables and Backtracking & Concept of Unification.
5	Implementation of Recursion in PROLOG.
6	Implementation of LIST and built-in predicates of LIST in PROLOG.
7	Implementation of State-Space Searching Problem using PROLOG (Water-Jug or 8 Queens problem).
8	Universal and Existential Quantifier Variables in PROLOG.
9	Knowledge Base and Rule Base Creation for a specific domain in PROLOG.
10	Implementation of Resolution process in PROLOG.
11	Implementation of an Expert System for a particular domain.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	**Mathematics**
2. Course Code	**MAF108**
3. Course Title	**CALCULUS-I**
4. Credits (L:T:P:C)	**3:1:0:4**
5. Contact Hours (L:T:P)	**3:1:0**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Generic Elective**

COURSE SUMMARY

COURSE OBJECTIVES

To prepare the students with basic concepts of limit, continuity, differentiability, and integration of functions and their applications.

COURSE OUTCOMES

Students will be able to:

1. find derivative and anti-derivative of various functions and use them for further study
2. draw graph of various functions in Cartesian and Polar coordinates
3. determine area, volume, surface od revolutions using definite integrals
4. use the concepts of calculus in higher learning.

CURRICULUM CONTENT

UNIT I: Limit and Continuity

Review of functions of single variable: Exponential, Logarithmic, Trigonometric and Hyperbolic functions, Limit, Continuity, Algebra of limits and continuous functions. **[8]**

UNIT II: Differentiability

Differentiability, Indeterminate forms, L' Hospital rule, Rolle's Theorem, Mean value theorems & their applications, Successive differentiation, Leibnitz theorem, Maclaurin & Taylor series of functions of one variable. **[10]**

UNIT III: Applications of Derivatives

Review conic sections and their Graphs, Monotonicity, Maxima and Minima, Concavity, Convexity, Point of inflection & Asymptotes, Polar coordinates, Curvature, Envelope of a family of curves, Graphs of functions and curves.

[10]

UNIT IV: Integral Calculus

Review of indefinite and definite integrals, Fundamental theorem of integral calculus, Integral as the limit of sum, Area, Volume and surface of revolution, Arc lengths, Double and triple integrals, Change of order of integration, Change of variables, Dirichlet's integral, Application of multiple integrals. **[12]**

Text Books:

1. G. B. Thomas and R. L. Finney, "Calculus and Analytic Geometry", 9th Edition, Pearson Education India, 2010

Reference Books:

1. R. K. Jain, & S. R. K. Iyenger,"Advanced Engineering Mathematics", 4thEdition, Narosa Publishing House, New Delhi, India, 2014.
2. E. Kreyszig, "Advanced Engineering Mathematics**"**, 10thEdition, John & Wiley Sons, U.K., 2016.
3. Gorakh Prasad, "Integral Calculus", Pothishala Private Limited, 2015

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	**Mathematics**
2. Course Code	**MAF117**
3. Course Title	**Ordinary Differential Equations**
4. Credits (L:T:P:C)	**3:1:0:4**
5. Contact Hours (L:T:P)	**3:1:0**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Generic Elective**

COURSE SUMMARY

COURSE OBJECTIVE

This course provides an introduction to the fundamentals of ordinary differential equations and their solutions.

COURSE OUTCOMES

After completing this course, students should demonstrate competency in the following skills:

1. To understand the order and degree of differential equations and classify them to linear or nonlinear differential equations.
2. To determine the solution of differential equation of first order and first degree.
3. To understand and identify higher order linear differential equation and determine their solutions by various methods.
4. To understand and recognize fundamentals of singular solutions, Clairaut's equations.

CURRICULUM CONTENT

UNIT I: Differential Equations of first Order & first Degree

Formation of differential equations, order and degree of differential equations, complete primitive, methods to solve the differential equations of first order and first degree; separation of variables, homogeneous differential equations, exact differential equations, equations reducible to separation of variables, homogeneous and exact differential equations, linear differential equations, equations reducible to linear differential equation. [10]

Unit- II: Equations of first order but not of first degree & Trajectories

Equations of first order but not first degree, Various cases & various methods to determine solution, Singular solutions, Clairaut's form, Trajectory, Orthogonal trajectory Self-orthogonal family of curves.

[8]

UNIT III: Second and Higher Order ODE

Solution of homogeneous and non-homogeneous linear ODE with constant coefficients using inverse operator method and method of undetermined coefficients, Euler-Cauchy homogeneous linear differential equations, Simultaneous differential equations, Method of variation of parameters, Solution of second order differential equations by changing dependent and independent variable.

[12]

Unit – IV: Simultaneous linear differential equations & second order linear differential equations with variable coefficients

Simultaneous linear differential equations with constant coefficients, Linear differential equations of second order with variable coefficients, following cases: the complete solution in terms of a known integral, finding one integral in C.F. by inspection, reduction to normal form, Change of independent variable, method of variation of parameters, Simultaneous equations of the form $P_1dx + Q_1dy + R_1dz = 0,\ P_2\,dx + Q_2dy + R_2\,dz = 0.$

[10]

Text Books:

1. M. D. Raisinghania, "Ordinary and Partial Differential Equations", 19th Edition, S. Chand Publications, 2017.
2. 2. G. F. Simmons and G. Krantz Steven, "Differential Equations", 17th Reprint, McGraw Hill Education (India) Private Ltd., 2016.

Reference Books:

1. M. Tenenbaum, and H. Polard, "Ordinary Differential Equations", Dover Publications, 1985.
2. V.P. Mishra, and J. Sinha, "Elements of Engineering Mathematics", 3rd Edition, S.K. Kataria& Sons, 2013.
3. E. Kreyszig, "Advanced Engineering Mathematics", 10th Edition, published by John Wiley & Sons, U.K, 2011.
4. B. Rai, D.P. Choudhary and H.I. Freedman, "A Course in Ordinary Differential Equations", 2nd Edition, Narosa Publishing House, 2013.
5. B.S. Grewal, "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, 2012

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	**Mathematics**
2. Course Code	MAF206
3. Course Title	**Computer Based Numerical Techniques**
4. Credits (L:T:P:C)	**3:1:4:6**
5. Contact Hours (L:T:P)	**3:1:4**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Generic Elective**

Course Objective: To enable students to obtain an intuitive and working understanding of numerical methods for the basic problems of numerical analysis and gain experience in the implementation of numerical methods using a computer.

Unit I: Solution of system of linear equations:
[7]

Direct methods: Matrix inverse method, Gauss elimination, Gauss-Jordan method and LU decomposition method, Iterative methods: Jacobi's method, Gauss-Seidal method

Unit II: Solution of Algebraic and Transcendental equations:
[9]

Initial approximation of the roots, Bisection method, Method of false position, secant method, iteration method, Newton-Raphson method and its convergence.

Unit III: Finite differences and interpolation:
[12]

Finite difference operators, their properties and their interrelations, finite difference tables, Newton's forward and Newton's backward interpolation formula, various central difference formulae including Stirling's formula, Bessel's formula. Divided differences: Operators and difference table, Newton's divided difference formula, Lagrange's interpolation formula.

Unit IV: Numerical differentiation and integration:
[12]

Differentiation using Newton's forward and backward interpolation formula, Newton-Cotes quadrature formula - derivations & comparison of Trapezoidal rule, Simpsons 1/3 and 3/8 rules. Numerical solution of first order differential equations: Euler's method, modified Euler's method, Runge-Kutta second order and fourth order methods.

Text Books:

- B. S. Grewal, **Numerical Methods in Engineering and Science,** (9th Edition), Khanna Publishers, New Delhi, India, 2010.

Reference Books:

- S.S. Sastry, **Introductory Methods of Numerical Analysis,** 4th edition, PHI learning Pvt. Ltd, 2005.
- Curtis F. Gerald and Patrick O. Wheatley**, Applied Numerical Analysis,** 7th Edition, Pearson Education Lt, 2009.
- M.K Jain, S.R.K Iyengar and R.K Jain, **Numerical Methods for Scientific and Engineering computation, 4th**Edition, New age International Publishers, 2003.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

List of Practical:

(1) Bisection Method.

(2) Regula Falsi method.

(3) Newton Raphson method.

(4) Gauss Elimination method.

(5) Gauss - Jacobi Method.

(6) Gauss - Seidal Method.

(7) Newton's Forward Interpolation Formula.

(8) Newton's Backward Interpolation Formula.

(9) Trapezoidal rule.

(10) Simpson's $\frac{1}{3}rd$ rule.

(11) Simpson's $\frac{3}{8}rd$ rule.

(12) Euler's method.

(13) Fourth order Runge - Kutta methods.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	**Mathematics**
2. Course Code	**MAF216**
3. Course Title	**PROBABILITY THEORY AND MATHEMATICAL STATISTICS**
4. Credits (L:T:P:C)	**3:1:4:6**
5. Contact Hours (L:T:P)	**3:1:4**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Generic Elective**

COURSE SUMMARY

COURSE OBJECTIVE

The objectives of the course include the following points: To relate the common statistical behavior of real phenomenon with distribution theory. Recognition of the statistical distributions. Applications of the basic statistical laws in real life problems. Establishment and analysis of regression problems for descriptive data as well as for mathematical/statistical functions.

Course Pre/Co- requisite (if any) : Basic idea about the descriptive statistics and probability.

COURSE OUTCOME

6. Students shall have good knowledge of statistical distributions and their real life applications.
7. The course results a better understanding of the bivariate data and its graphical as well as numerical interpretations.
8. The outcome of this course includes to differentiate between the mathematical models and the probabilistic models and, hence, the regression models.
9. Students shall able to perform the regression analysis and prediction of the data points based on regression model.

Detailed Syllabus

UNIT- I

[10]

Descriptive statistics and probability: measures of central tendency, dispersion, skewness and kurtosis. Types of variables. Graphical representations in data analysis. Probability, Bayes theorem, random variables and probability functions.

UNIT-II

[9]

Standard Discrete Probability Distributions: Binomial, Poisson, Geometric, Negative Binomial, Hyper-geometric distributions and their parameters. Applications of the discrete probability distributions.

UNIT –III
[10]

Standard continuous probability distributions: Normal, Uniform, Exponential, Gamma distributions and their parameters, Applications of the continuous probability distributions.

UNIT- IV
[10]

Regression Analysis: Scatter diagram, Covariance, Coefficient of correlation, Spearman's rank correlation coefficient and Regression coefficients, Two lines of regression X on Y and Y on X, Two variable linear model: Estimation, Testing and problems of predication, Predication of the estimated regression equation, applications of regression analysis in real life problems.

List of Practicals:

1. Draw histogram for equal/unequal width class interval, Stem and Leaf plot,Box plot frequency polygon, pie chart, bar graphs, line charts, Ogive.
2. Construct frequency table using recode (having equal and unequal interval) and visual binning.
3. Compute descriptive statistics for raw data and grouped data and interpret by computing coefficient of variation, skewness and kurtosis.
4. Use of count, compute, compute with if and rank feature.
5. Calculate correlation coefficient (Karl Pearson), Spearman's rank correlation coefficient, Multiple and Partial correlation coefficient.
6. Generation of random sample from Binomial, Poisson, Negative binomial, Uniform, Exponential, Normal, Gamma and distributions Stem and Leaf plots and Box Plots for these random Samples.
7. Compute $F(x) = P(X \leq x)$ for random sample of observations drawn from theoretical distributions.
8. Computation of marginal probability functions and conditional probability.
9. Fitting of two lines of regression and their plot.
10. Estimation using regression lines.

Text books:

3. S.C. Gupta, V.K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, 2016.
4. V. K. Rohatgi, "Introduction to Probability Theory and Mathematical Statistics", Wiley Eastern, Latest Edition.

Reference books:

4. A.M. Goon, M.K. Gupta, and B. Dasgupta, "An Outline of Statistical Theory", 4th Edition, World Press, Kolkata, 2003.
5. R.V. Hogg, and E.A. Tanis, "A Brief Course in Mathematical Statistics", Pearson Education, 2009.
6. Sheldon Ross, "Introduction to Probability Models", 9th Edition, Academic Press, Indian Reprint, 2007.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	Chemistry
2. Course Code	CHF107
3. Course Title	Physical Chemistry-I
4. Credits (L:T:P:C)	3:1:2:5
5. Contact Hours (L:T:P)	3:1:2
6. Prerequisites (if any)	None
7. Course Basket	Generic Elective

COURSE SUMMARY:

The course covers the gaseous states kinetics and P-V-R relations in the first unit. The second unit is renders details of the types of crystalline packing and symmetry for prototype crystalline solids. The third, fourth and fifth unit covers the thermodynamics of gaseous expansions and compressions and changes in intrinsic parameters, like, enthalpy, internal energy during gaseous phase reactions.

COURSE OBJECTIVE:

The objectives of this course involve learning of the basics concepts of thermodynamics and to be able to identify and describe energy exchange processes of reactions.

COURSE OUTCOME:

On successful completion of the course, students will be able to achieve the following:

1. Explain the kinetic of gaseous diffusion and viscosity based on various parameters; understanding of gaseous mixture separation based on partial pressures.
2. Explain the crystal structures and symmetry elements present in various crystal based on the understanding of X-ray diffraction technique of Crystal lattices.
3. Formulate various derivations expressing the intrinsic and extrinsic parameters of reaction thermodynamics and Free energy-enthalpy correlations and their implications in the reaction monitoring.
4. Predict the Thermo chemistry of various types of reactions based on Enthalpy expressions.

Course Pre/Co- requisite (if any): The student must have basic knowledge of gaseous laws and equations regarding Pressure-Volume-Temperature dependency of gaseous molecules. Students should also have prior understanding of crystalline nature of well-known salts (NaCl) to be further explained and basis of homogenous solutions and colloidal suspensions.

CURRICULUM CONTENT

Unit I: Gaseous state:

Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free path and coefficient of viscosity, calculation of σ

from η; variation of viscosity with temperature and pressure.

Unit 2: Solid State:

Definition of space lattice, unit cell, Laws of crystallography – (i) Law of constancy of interfacial angles, (ii) Law of rationality of indices (iii) Law of symmetry, Symmetry elements in crystals. X-ray diffraction by crystals, Derivation of Bragg equation, Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method).

UNIT 3: Chemical Thermodynamics:

Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics. First law: Concept of heat, q, work, w, internal energy, U, and statement of first law; enthalpy, H, relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions.

UNIT 4: Thermochemistry, Second and Third law of thermodynamics:

Thermochemistry: Heats of reactions: standard states; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions. Adiabatic flame temperature, explosion temperature.

Second Law: Concept of entropy; thermodynamic scale of temperature, statement of the second law of Thermodynamics; molecular and statistical interpretation of entropy. Calculation of entropy change for reversible and irreversible processes.

Third Law: Statement of third law, concept of residual entropy, calculation of absolute entropy of molecules.

UNIT 5: Free Energy functions and Systems of Variable Composition:

Free Energy Functions: Gibbs and Helmholtz energy; variation of S, G, A with T, V, P; Free energy change and spontaneity. Relation between Joule-Thomson coefficient and other thermodynamic parameters; inversion temperature; Gibbs-Helmholtz equation; Maxwell relations; thermodynamic equation of state.

Systems of Variable Composition: Partial molar quantities, dependence of thermodynamic parameters on composition; Gibbs-Duhem equation, chemical potential of ideal mixtures, change in thermodynamic functions in mixing of ideal gases.

TEXT BOOKS

1. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 8th Ed., Oxford University Press (2006).
2. Ball, D. W. Physical Chemistry Thomson Press, India (2007).
3. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
4. Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).

SR.NO.	EXPERIMENT NAME
1	To determine the enthalpy of neutralization of a weak acid/weak base versus strong base/strong acid and determine the entrhalpy of ionization of the weak acid/weak base.
2	To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy datausing Born Haber Cycle.
3	Determination of heat capacity of a calorimeter for different volumes using change of enthalpy data of a known system (method of back calculation of heat capacity of calorimeter from known enthalpy of solution of sulphuric acid or enthalpy of neutralization), and (ii) heat gained equal to heat lost by cold water and hot water respectively
4	Determination of heat capacity of a calorimeter for different volumes using heat gained equal to heat lost by cold water and hot water respectively
5	Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
6	Study of the solubility of benzoic acid in water and determination of ΔH.
7	Determination of integral enthalpy (endothermic and exothermic) solution of salts.
8	Calculation of enthalpy of ionization.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	Chemistry
2. Course Code	CHF117
3. Course Title	Physical Chemistry-II
4. Credits (L:T:P:C)	3:1:2:5
5. Contact Hours (L:T:P)	3:1:2
6. Prerequisites (if any)	Physical Chemistry - I
7. Course Basket	Generic Elective

COURSE SUMMARY:

The course covers the basic concepts related to types of bonding and properties of liquids in unit one. The second unit covers the equilibrium chemistry of solution phase reactions and calculations of quantitative determination of concentration changes with reaction progression. The third unit covers the colligative properties of real solutions. Colloidal state is been discussed in unit four while in unit five ionic equilibrium is discussed in detail.

COURSE OBJECTIVE:

The objective of this course is to acquaint the student with the basic phenomenon/concepts of equation of state and properties of liquid. In this module students will learnt about chemical equilibrium, its types and the factors affecting the state of equilibrium. In this the lesson you will learn about the equilibria involving ionic species.

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

1. Understand different concepts related to type of bonding and properties of liquid.
2. Derive Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient.
3. Understand the basic concepts associated with LeChatelier's Principle.
4. Know about basic concepts of acids and basis and also about salt hydrolysis.

COURSE PRE/CO- REQUISITE (IF ANY) :

The student must have gained ample understanding of the course Physical Chemistry-I taught at semester-I and cleared the paper.

CURRICULUM CONTENT

Unit I: Liquid State

Qualitative treatment of the structure of the liquid state; Radial distribution function; physical properties of liquids; vapor pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity. Explanation of cleansing action of detergents. Temperature variation of viscosity of liquids and

comparison with that of gases. Qualitative discussion of structure of water.

Unit 2: Chemical Equilibrium

Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases. Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Equilibrium constants and their quantitative dependence on temperature, pressure and concentration (LeChatelier Principle, Quantitatively)). Free energy of mixing and spontaneity of equilibrium between ideal gases and a pure condensed phase.

Unit 3: Solutions and Colligative Properties

Dilute solutions; lowering of vapour pressure, Raoult's and Henry's Laws and their applications. Thermodynamic derivation using chemical potential to derive relations between the four colligative properties [(i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) osmotic pressure] and amount of solute. Applications in calculating molar masses of normal dissociated and associated solutes in solution.

Unit 4: Colloidal State:

Definition of colloids, classification of colloids; Solids in liquids (sols): properties – kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schulze law, gold number. Liquids in liquids (emulsions): types of emulsions, preparation, Emulsifier, Liquids in solids (gels) : classification, preparation and properties, inhibition, general application of colloids, colloidal electrolytes.

Unit 5: Ionic Equilibrium

Strong, moderate 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 mono- di-and triprotic acids (exact treatment).

Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its application; buffer capacity, buffer range, buffer action and applications buffers in analytical chemistry and biochemical processes in the human body.

TEXT BOOKS

1. Khosla, B. D.; Garg, V. C. &Gulati, A., Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).

2. Athawale, V. D. &Mathur, P. Experimental Physical Chemistry New Age International: New Delhi (2001).

REFERENCE BOOKS

1. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 8th Ed., Oxford University Press (2006).

2. Ball, D. W. Physical Chemistry Thomson Press, India (2007).
3. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
4. Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).

SR.NO.	EXPERIMENT NAME
1	Determination of the transition temperature of the given substance by thermometric /dialometric method (e.g. $MnCl_2.4H_2O$/$SrBr_2.2H_2O$).
2	To study the effect of a solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that solute in the given phenol-water system.
3	To construct the phase diagram of two component (e.g. diphenylamine – benzophenone) system by cooling curve method.
4	**Surface tension measurements** (use of organic solvents excluded). (a)Determine the surface tension by (i) drop number (ii) drop weight method. (b)Study the variation of surface tension of detergent solutions with concentration
5	**Viscosity measurement using Ostwald's viscometer:** Study the effect of variation of viscosity of an aqueous solution with the concentration of solute.
6	**pH measurements** (a)Measurement of pH of different solutions using pH-meter. (b)Preparation of buffer solutions (i) Sodium acetate-acetic acid (ii) Ammonium chloride-ammonium hydroxide
7	**pH metric titrations of** (i)strong acid and strong base (ii)weak acid and strong base

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	Chemistry
2. Course Code	CHF208
3. Course Title	Physical Chemistry-III
4. Credits (L:T:P:C)	3:1:2:5
5. Contact Hours (L:T:P)	3:1:2
6. Prerequisites (if any)	Physical Chemistry - II
7. Course Basket	Generic Elective

COURSE SUMMARY:

This course covers the concept of phases, fundamental of electrochemistry, applications of electrochemistry, distribution Law and applications of distribution law.

COURSE OBJECTIVE:

The objective of this course is to learn basics concepts of electrolytic solutions and electrolytes. It will also give the information regarding the number of phase present in a chemical component and to know their applications in various fields.

COURSE OUTCOME

On successful completion of the course, students will be able to achieve the following:

1. Predict the reactivity of an organic compound from its structure.
2. Develop basic skills for the multi-step synthesis of organic compounds.
3. Justify a reasonable mechanism for a chemical reaction.
4. Identify name the functional groups and different class of organic compounds
5. Predict electronic flow and arrow pushing mechanism in a chemical reaction.

CURRICULUM CONTENT

Unit I: Phase Equilibria-I

Concept of phases, components and degrees of freedom, derivation of Gibbs Phase Rule for non- reactive and reactive systems; Clausius-Clapeyron equation and its applications to solid-liquid, liquid- vapour and solid-vapourequilibria, phase diagram for one component systems, with applications.Phase diagrams for systems of solid-liquid equilibria involving eutectic, congruent and incongruent melting points, solid solutions.Three component systems, water-chloroform-acetic acid system, triangular plots.

Unit II: Phase Equilibria-II

Binary solutions: Gibbs-Duhem-Margules equation, its derivation and applications to fractional distillation of binary miscible liquids (ideal and non ideal), azeotropes, lever rule, partial miscibility of liquids, CST, miscible pairs, steam distillation.

Unit III: Fundamental of Electrochemistry -I

Electrical transport:-Conduction in metals and in electrolyte solutions, specific conductance molar and equivalent conductance, measurement of equivalent conductance, variation of molar equivalent and specific conductance with dilution. Migration of ions and Kohlrausch's law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law its uses and limitations.

Unit IV: Fundamental of Electrochemistry -II

Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only),wien effect, Debye- Falkenhagen effect and Walden"s effect. Transport number, definition and determination by Hittorf's method and moving boundary method. Applications of conductivity measurements:

determination of degree of dissociation, determination of Ka of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

Unit V - Distribution Law

Nernst distribution law – its thermodynamic derivation, Modification of distribution law when solute undergoes dissociation, association and chemical combination. Applications of distribution law:

(i) Determination of degree of hydrolysis andhydrolysis constant of aniline hydrochloride.

(ii) Determination of equilibrium constant of potassium tri-iodide complex and process of extraction.

Text book [TB]:

1. Essentials of Physical Chemistry By Arun Bahl, B.S Bahl, G.D.Tuli, S Chand Publishing 2014.

Reference books [RB]:

1. Atkins, P. W. & Paula, J. de *Atkin's Physical Chemistry* 8th Ed., Oxford University Press (2006).
2. Ball, D. W. *Physical Chemistry* Thomson Press, India (2007).
3. Castellan, G. W. *Physical Chemistry* 4th Ed. Narosa (2004).
4. Mortimer, R. G. *Physical Chemistry* 3rd Ed. Elsevier: NOIDA, UP (2009).

R.NO.	LIST OF EXPERIMENTS
1	Study the equilibrium of at least one of the following reactions by the distribution method: (i) $I_2(aq) + I^- \rightarrow I_3^-(aq)$ (ii) $Cu^{2+}(aq) + nNH_3 \rightarrow Cu(NH_3)_n^{2+}$

2	Perform the following potentiometric titrations (at least two): (i) Strong acid with strong base (ii) weak acid with strong base and (iii) dibasic acid with strong base
3	Potentiometric titration of Mohr's salt with potassium dichromate
4	Determination of critical solution temperature and composition of the phenol-water system and to study the effect of impurities on it.
5	Phase equilibria: Construction of the phase diagram of (i) simple eutectic and (ii) congruently melting systems, using cooling curves and ignition tube methods

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	Chemistry
2. Course Code	CHF218
3. Course Title	Physical Chemistry-IV
4. Credits (L:T:P:C)	3:1:2:5
5. Contact Hours (L:T:P)	3:1:2
6. Prerequisites (if any)	Physical Chemistry - III
7. Course Basket	Generic Elective

COURSE SUMMARY:

This course covers electrochemistry of electrolytes; kinetics of chemical reactions, reactions under photolytic conditions, role of catalyst in chemical reactions also covers physical properties.

COURSE OBJECTIVE:.

The Main objective of this course is to understand the Physical Properties of matter with respect to the surrounding environment. The hands on practices through experiment are also provided to the students.

COURSE PRE/CO- REQUISITE (IF ANY) :

The student must have basic knowledge of electrostatics and magnetostatics.

CURRICULUM CONTENT

Unit I : Electrochemistry-(II) 9 Hrs

Quantitative aspects of Faraday's laws of electrolysis, rules of oxidation/reduction of ions based on half-cell potentials, applications of electrolysis in metallurgy and industry.Chemical cells, reversible and irreversible cells with examples.Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential and its application to different kinds of half-cells.

Unit IV: Applications of Electrochemistry 9Hrs

Application of EMF measurements in determining (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values, using hydrogen, quinone-hydroquinone, glass and SbO/Sb2O3 electrodes. Concentration cells with and without transference, liquid junction potential; determination of activity coefficients and transference numbers. Qualitative discussion of potentiometric titrations (acid-base, redox, precipitation)

Unit II: Chemical Kinetics 9 Hrs

Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions up to second order reactions, experimental methods of the determination of rate laws, kinetics of complex reactions (integrated rate

expressions up to first order only): (i) Opposing reactions (ii) parallel reactions and (iii) consecutive reactions and their differential rate equations (steady-state approximation in reaction mechanisms)
(iv) chain reactions.
Temperature dependence of reaction rates; Arrhenius equation; activation energy. Collision theory of reaction rates, Lindemann mechanism, qualitative treatment of the theory of absolute reaction rates.Surface chemistry: Physical adsorption, chemisorption, adsorption isotherms. nature of adsorbed state.

Unit III: Photochemistry 7 Hrs

Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws, of photochemistry, quantum yield, actinometry, examples of low and high quantum yields, photochemical equilibrium and the differential rate of photochemical reactions, photosensitised reactions, quenching. Role of photochemical reactions in biochemical processes, photostationary states, chemiluminescence

Unit IV: Catalysis & Surface Chemistry 6 Hrs

Catalysis: Types of catalyst, specificity and selectivity, mechanisms of catalyzed reactions at solid surfaces; effect of particle size and efficiency of nanoparticles as catalysts. Enzyme catalysis, Michaelis-Menten mechanism, acid-base catalysis.

Surface chemistry: Physical adsorption, chemisorption, adsorption isotherms. Nature of adsorbed state, Adsorption of gases on solids, Freundlich isotherm , Langmuir adsorption isotherm and BET isotherms

Unit V: Physical Properties and Chemical Constitution 8 Hrs

Surface Tension and Chemical Constitution, use of Parachor in elucidating structure, Viscosity and Chemical Constitution, Dunstan Rule, Molar Viscosity, Rheochor, Dipole Moment, Determination of Dipole moment, Dipole moment and molecular structure, Dipole moment and Ionic Character, Molar refraction and chemical constitution, Optical activity and chemical constitution, Magnetic properties, Paramagnetic and Diamagnetic Substances.

COURSE OUTCOME:-

At the end of the course, the student can:

1. To understand the electrolysis process and principles involved.
2. To study the rate of reaction and effect of physical properties on it.
3. To study the photonic properties of electrons and it behavior towards light.
4. Effect of Catalyst on the reaction mechanism.
5. To study the different processes in gaseous state.

TEXT BOOKS

Essentials of Physical Chemistry By ArunBahl, B.S Bahl, G.D. Tuli, S Chand Publishing 2014.

REFERENCES BOOK:-

1. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 8th Ed., Oxford University Press (2006).
2. Ball, D. W. Physical Chemistry Thomson Press, India (2007).
3. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
4. Laidler, K. J. Chemical Kinetics Pearson Education: New Delhi (2004).

SR.NO.	EXPERIMENT NAME
1	**To study changes in conductance in the following systems** (i) strong acid-strong base (ii) weak acid-strong base and (iii) mixture of strong acid and weak acid-strong base
2	**Study the kinetics of the following reactions.** 1. Initial rate method: Iodide-persulphate reaction 2. Integrated rate method: (a) Acid hydrolysis of methyl acetate with hydrochloric acid, volumetrically or conductometrically. (b) Iodide-persulphate reaction (c) Saponification of ethyl acetate.
3	i)To study the effect of acid strength on the hydrolysis of an ester. (ii)To compare the strengths of HCl and H_2SO_4 by studying the kinetics of hydrolysis of ethyl acetate.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

Language and Literature (Minimum 3 credits to be taken)

1. Department offering the course	**Humanities & Liberal Arts**
2. Course Code	**LAF181**
3. Course Title	**Professional Communication**
4. Credits (L:T:P:C)	**2:0:2:3**
5. Contact Hours (L:T:P)	**2:0:2**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Language and Literature**

COURSE SUMMARY

This course is to enhance the Communication Skills of the students. It also focuses on Basic facets of communication. It introduces the students to LSRW and Non-verbal Language and how to master these aspects to be an effective communicator.

COURSE OBJECTIVES

The course aims at developing the LSRW skills of students for effective communication. Also to equip them for a business environment. It also focusses at preparing the students understand and present themselves effectively.

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. Communicate smoothly
2. Greater self-confidence and knowledge of life skills helps them to develop healthier interpersonal relationships.
3. Present themselves effectively
4. Prepares the students to face future challenges and excel in their personal and professional lives.

Curriculum Content

Unit 1: Communication

Communication: Meaning, Types of Communication: General & Technical Communication Knowledge and adoption of Non Verbal cues of communication: Kinesics, Proxemics, Chronemics, Oculesics, Haptics, Paralinguistics, Barriers to Communication, Overcoming strategies.

Unit 2: Listening & Speaking Skills
Listening Comprehension: identifying General & Specific information, Note taking and drawing inferences. Introduction to Phonetics: Articulation of consonants and vowel sounds.

Unit 3: Reading Skills & Technical Writing Skills
Reading Strategies and Vocabulary Building Reading Comprehension, Paragraph development, Intra office Correspondence: Notice, Agenda, Minutes and Memorandum Technical Proposal & Report

Unit 4: Communication at Work
Business Letter Writing, Job Application Letter & Resume, Interview Skills, Impression Management, SWOT Analysis (Identifying Strength & Weakness), EQ and Its Dimensions

Textbook(s)

1. Rizvi, Ashraf. Effective Technical Communication, McGraw Hill, New Delhi. 2005.
2. Raman, Meenakshi and Sangeeta Sharma,. Technical Communication: Principles and Practice, 2nd Edition. New Delhi: Oxford University Press. 2011.

Reference Books

1. Aslam, Mohammad. Introduction to English Phonetics and Phonology Cambridge.2003.
2. Ford A, Ruther. Basic Communication Skills; Pearson Education, New Delhi.2013.
3. Gupta, Ruby. Basic Technical Communication, Cambridge University Press, New Delhi.2012.
4. Kameswari, Y. Successful Career Soft Skills and Business English, BS Publications,
5. Hyderabad.2010.
6. Tyagi, Kavita& Padma Misra. Basic Technical Communication, PHI, New Delhi. 2011.
7. Ghosh, B. N. Managing Soft skills for Personality development,Laxmi Publications Ltd., New Delhi, 2013.
8. Elizabeth B. Hurlock. Personality Development , TMH Publication,2010

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Assignments, Class Tests etc. will be done. Various teaching methods like Discussion Method, Case Study Method and Lecture Method will be adopted.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	**Humanities & Liberal Arts**
2. Course Code	**LAF182**
3. Course Title	**Indian English Literature**
4. Credits (L:T:P:C)	**3:0:0:3**
5. Contact Hours (L:T:P)	**3:0:0**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Language and Literature**

COURSE SUMMARY

Indian English Literature is an honest enterprise to demonstrate the ever rare gems of Indian Writing in English. From being a singular and exceptional, rather gradual native flare – up of geniuses, Indian Writing has turned out to be a new form of Indian culture and voice in which India converses regularly. This course will introduce various authors and will help to understand the role of literature in reflecting the social context and the shaping of a young nation.

COURSE OBJECTIVES

- The course will enable the students to understand the level of Indian English Literature. It will also enable the students to understand different genres such as prose, poetry, and fiction in Indian Writers in English.

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. The students will develop an insight into Indian literature.
2. The students will learn to appreciate different genres of literature of Indian Literature in English.
3. The students will understand the role of literature in reflecting the social context and the shaping of a young nation.
4. The students will demonstrate knowledge and comprehension of major texts and traditions of language and literature written in English as well as their social, cultural, theoretical, and historical contexts.

Curriculum Content

Unit 1

Prose

APJ Abdul Kalam: Unity of Minds

Swami Vivekananda: The Cosmos-Macrocosm

Mahatma Gandhi: Hind Swaraj, What is Civilization? (Chapter XIII) Education (Chapter XVIII)

Unit II
Poetry

Toru Dutt:	Our Casuarina Tree
Rabindranath Tagore:	Geetanjali – Where the mind is without fear
Sri Arbindo:	Stone Goddess
Sarojani Naidu:	Life
Nissim Ezekiel:	The Night of Scorpion
Kamla Das:	An Introduction

Unit III
Short Stories

R.N.Tagore:	Kabuliwala
Mulk Raj Anand:	Duty
R.K. Narayan:	An Astrologer's Day
NayantaraSehgal:	Martand

Unit IV
Novel
Ruskin Bond: Flights of Pigeons

Textbook(s).

1. Kumar, Shiv K. (ed),Contemporary Indian Short Stories in English, 2007 SahityaAkademi.
2. Anand, Mulk Raj; SarosCowasjee (ed.);Selected Short StoriesPenguin Books, 2006
3. Bond, Ruskin. Flights of Pigeons, Penguin Books, 2003

Reference Books

1. Tagore, Rabindra. *Nationalism*. Delhi: Rupa Publications, 1992.Print.
2. Chinhade, Sirish. *Five Indian English Poets*. New Delhi: Atlantic Publishers and Distributors, 1996.Print.
3. Naik, M.K. *A History of Indian English Literature*. New Delhi: SahityaAkademi, 2004.Print.
4. Agrawal, K.A. Ed. *Indian Writing In English: A Critical Study*. Atlantic Publishers &Dist, 2003.Print.

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	**Humanities & Liberal Arts**
2. Course Code	**LAF183**
3. Course Title	**English Language Teaching (ELT)**
4. Credits (L:T:P:C)	**3:0:0:3**
5. Contact Hours (L:T:P)	**3:0:0**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Language and Literature**

COURSE SUMMARY

This course will offer a historical perspective to the teaching of English as a second language. It will trace the changes in language teaching methods throughout history depending on changes in the kind of proficiency learners need. It includes the different approaches used over the years and their application in teaching English as a second language in the classroom. It also traces the status of English language and the 'World English' and how it affects the teaching of English.

COURSE OBJECTIVES

To introduce students to the nature of English language learning and its theoretical implications. The main objective of the course is to enable students to evaluate a variety of language learning methods and approaches. It also aims to empower students to understand ELT in their contexts of language learning.

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. Students will learn about communicative approaches to English language teaching.
2. Be able to understand the theories and methodologies of ELT
3. Be able to explore core components of communicative language teaching
4. Students will learn to apply ELT theories

Curriculum Content

Unit 1
Historical Perspective , ELT and its beginnings: development of reading approach, oral method and audio-lingual method

Unit 2
Communicative Language Teaching (CLT): the concept of 'communicative competence; ESL in India: a historical trajectory

Unit 3

Halliday's notion of 'transitivity' and 'meta-functions'

Corpus Linguistics ELT: corpus studies and how it can be used for language teaching

Unit 4

'World English' and ELT, Model of the 'Concentric Circles' and its impact on ELT

Textbook(s)

1. Maybin, Janet and Swann, Joan. (2009). The Routledge Companion to English Language Studies. London: Routledge, Print

Reference Books

1. Richards, J. & T.S. Rogers. (1986). Approaches and Methods in Language Teaching. Cambridge: Cambridge University Press, Print.
2. Ur, Penny. (1996). A Course in Language Teaching: Practice and Theory. Cambridge: Cambridge University Press, Print.

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	**Humanities & Liberal Arts**
2. Course Code	**LAF184**
3. Course Title	**Corporate Communication and Soft Skills**
4. Credits (L:T:P:C)	**2:0:2:3**
5. Contact Hours (L:T:P)	**2:0:2**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Language and Literature**

COURSE SUMMARY

This course is to enhance the soft skills of the students. It also focuses on business communication. It will help the students to develop professional skills and how to be effective communicator at work place.

COURSE OBJECTIVES

To introduce to students to the business & corporate environment and its expectations. To help students to identify and sharpen their personal and professional skills. To ensure employability of students through a perfect blend of hard & soft skills.

Course Outcomes

On successful completion of the course, students will be able to achieve the following:. Students identify their goals and through enhanced soft skills work towards achieving them.

1. Greater self-confidence and knowledge of life skills helps them to develop healthier interpersonal relationships.
2. Prepares the students to face future challenges and excel in their personal and professional lives.

Curriculum Content

Unit 1

Business Communication **8hrs**

Importance & Features of Business Communication, Flow of Communication: Channels &Networks

Business Presentation

Business Etiquette, Telephonic Etiquette

Interview Skills, Impression Management

Unit 2 **8hrs**

Business Letter Writing

Job Application Letter & Resume

Compunication: E mails & E- Tools

Unit 3

Personal Skills for Corporate Communication **8hrs**

SWOT Analysis: Self-Assessment, Identifying Strength & Weakness
Self-Awareness, Self-Disclosure & Self-Management (Stress, Anger)
Goal Setting: Personal & Professional Goals, SMART-ER Goals
Human Perception: Understanding People, Perceptions, Attitudes
Personality (Personality Test)

Unit 4 **8hrs**

Professional Skills for Corporate Communication

Decision Making: Techniques, Six Thinking Hats
Creative Thinking, Lateral Thinking
Team Building & Leadership Skills
Time Management: Planning Organizing, Time Wasters
Conflict Resolution Skills
Negotiation Skills

Lab 1 Telephone Etiquette: Making an appointment, answering calls (Role Play)
Lab 2 Telephone Etiquette: Making an appointment, answering calls (Role Play)
Lab 3 Business Presentations (PPT Presentation)
Lab 4 Business Presentations (PPT Presentation)
Lab 5 Interview Skills: Mock Interview
Lab 6 Interview Skills: Mock Interview
Lab 7 Panel Discussion
Lab 8 Panel Discussion
Lab 9 Conflict & Negotiation (Situational Role Play)
Lab 10 Conflict & Negotiation (Situational Role Play)
Lab 11 Evaluation
Lab 12 Evaluation

TEXT BOOKS

1. Rizvi, Ashraf. Effective Technical Communication, McGraw Hill, New Delhi. 2005.
2. Gulati, Sarvesh. Corporate Soft skills, Rupa & Company, 2006

REFERENCE BOOKS

1. Steven R. Covey. The Seven Habits of Highly Effective People, Simon and Schuster, London, 2007.
2. Robbins, Stephen. Management, Pearson Prentice Hall. 2009
3. Carnegie, Dale. How to win Friends and influence People, Simon and Schuster, London, 2009.
4. Dr. Alex. Soft Skills: Know Yourself & Know the World, S. Chand Publications, 2001.
5. Gopalswamy, Ramesh. The ACE of Soft Skills: Attitude, Communication and Etiquette for Success, Pearson, New Delhi, 2008.

6. Ghosh, B. N. Managing Soft skills for Personality development, Laxmi Publications Ltd., New Delhi, 2013.
7. Elizabeth B. Hurlock. Personality Development, TMH Publication, 2010.

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded on online platform.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

Humanities and Liberal Arts (Minimum 6 credits to be taken)

1. Department offering the course	**Humanities & Liberal Arts**
2. Course Code	**LAF281**
3. Course Title	**Introduction to Psychology**
4. Credits (L:T:P:C)	**3:0:0:3**
5. Contact Hours (L:T:P)	**3:0:0**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Humanities & Liberal Arts**

COURSE SUMMARY

This course will highlight the most interesting scientific findings and insights of psychology, discussing the implications of those for our understanding of the human mind and human behaviour. We will explore some of the cognitive abilities including memory, learning, attention, perception and consciousness. We will examine the trajectory of growth of psychological perspectives. By the end of this course you will have gained a fascinating understanding and appreciation of who you are and how you work and relate with others. And I can guarantee you that you'll learn things that you'll be telling your friends and family about, things that will fundamentally change the way you think of yourself and others.

COURSE OBJECTIVES

The purpose of this course provides coverage for the broad range of COURSE OUTCOMEs that may be taught in introductory psychology courses. With the goal of supporting faculty in the selection of content for their courses, we have organized this course around the 5 pillars, or domains, of psychology as recently recommended by the American Psychological Association: biological pillar, cognitive pillar, developmental pillar, and social and personality pillar, mental and physical health pillar.

COURSE OUTCOMES

On successful completion of the course, students will be able to achieve the following:

1. Identify the various approaches, fields, and subfields of psychology along with their major concepts and important figures
2. Describe the strengths and weaknesses of descriptive, experimental, and correlational research
3. Explain how nature, nurture, and epigenetics influence personality and behaviour
4. Explain the physical, cognitive, and emotional development that occurs from infancy through childhood
5. Recognize aspects of social psychology, including the fundamental attribution error, biases, social roles, and social norms, in your daily life.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

CURRICULUM CONTENT

Unit 1 Introduction

Definition, Scope, Perspectives: biological, psychoanalytic, behavioural, cognitive, humanistic, Methods: experiment, case study

Unit 2 Cognitive Processes

Perception: Meaning, laws of perceptual organization, identifying perceptual errors; Techniques for improving our behaviors: Classical conditioning, Reinforcement theory & Modeling; Creative Thinking & Problem-Solving

Unit 3 Motivation and Emotion

Motivation: definition, self-motivation through goal setting, self-regulation, motivating employees, improving confidence; Emotion: definition, types, emotion and health, assessing emotional intelligence, body language

Unit-4 Human abilities

Self & Personality: definition, approaches for assessment, exploration through JOHARI Window; Understanding intelligence; Stress: meaning & coping; Conflict: definition & resolution;

TEXT BOOKS

1. Baron, R.A. and Misra, G., Psychology (Indian Subcontinent Edition). Person Education Ltd. (2014)
2. Chadha, N.K. & Seth, S., The Psychological Realm: An Introduction. Pinnacle Learning, New Delhi. (2014)

REFERENCE BOOKS

1. Ciccarelli, S.K. & Meyer, G.E., Psychology (South Asian Edition). New Delhi: Tata Mc Graw Hill. (2008).
2. Glassman, W.F., Approaches to Psychology (3rd Ed.) Buckingham: Open University Press. (2000).
3. Passer, M.W., Smith, R.E., Holt, N. and Bremmer, A., Psychology: The Science of Mind and Behaviour, McGraw-Hill Education, UK. (2008).

Teaching and Learning Strategy

All materials (PPTs, Assignments, Seminars, etc.) will be uploaded on online platform.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1	**Department offering the course**	**Humanities & Liberal Arts**
2	**Course Code**	**LAF381**
3	**Course Title**	**Positive Psychology and Living**
4	**Credits (L:T:P:C)**	**3:0:0:3**
5	**Contact Hours (L:T:P)**	**3:0:0**
6	**Prerequisites (if any)**	**NIL**
7	**Course Basket**	**Humanities & Liberal Arts**

COURSE SUMMARY

This course provides an introduction to the science related to happiness, well-being, flourishing and the positive aspects of human experience. This course discusses research findings in the field of positive psychology. It also features practical applications of this science that you can put to use immediately to help you live a full and meaningful life.

COURSE OBJECTIVES

The purpose of this course is to provide increase awareness for relevance of positive emotions at workplace. Students will gain psychological skills to maximize happiness and virtues like compassion, love and wisdom through experiential, workshop based and interactive activities along with assigned lectures and reading. Students will have an opportunity to explore the concepts (e.g., biological, psychological, social, emotional), the research behind the concepts, and evidence-based experiential activities that enhance well-being. Students will engage in a detailed analysis and evidence-based positivity change process utilizing validated questionnaires and positive psychology and well-being enhancing interventions.

COURSE OUTCOMES

On successful completion of the course, students will be able to achieve the following:

1. Students learn about modern psychological knowledge of happiness.
2. Students acquire skills to cultivate positive emotions.
3. Measure and build individual, workplace and educational flourishing; plan, implement and assess positive psychology.
4. Students will gain an understanding of what contributes to well-being and how to build the enabling conditions of a life worth living.

CURRICULUM CONTENT

Unit 1: What is positive psychology?

Introducing Positive Psychology: Definition, goals, assumptions, key concepts and relationships with health psychology, developmental psychology, social psychology and psychology of religion, Meaning and measure of Happiness: Hedonic and Eudemonic perspective, Yogic notion of bliss

Unit 2: Positive Emotions, Cognitive states and Well-being

What are positive emotions? The broaden and build theory, relevance of positive emotional states for physical, social & psychological resources, Positive emotions and well-being: Happiness and positive behavior, positive emotions and success, resilience, Self-efficacy, Optimism, Hope, Wisdom, Mindfulness and flourishing

Unit 3: How to enhance well-being?

Use of postures, breathing practices, Sounds, dietary consumption

Unit 4: Positive Psychology at work place

Maximizing achievement, conflict resolution, gratitude, positive leadership

Textbook(s)

Snyder (2011). Positive Psychology: The Scientific and Practical Explorations of Human Strengths. New Delhi: Sage.

Reference Books

1. Carr, A. (2004). Positive Psychology: The science of happiness and human strength.UK: Routledge.
2. Peterson, C. (2006). A Primer in Positive Psychology. New York: Oxford University Press.
3. Seligman, M.E.P. (2002). Authentic Happiness: Using the New Positive Psychology to Realize YourPotential for Lasting Fulfillment. New York: Free Press/Simon and Schuster.
4. Snyder, C.R., & Lopez,S.J.(2007). Positive psychology: The scientific and practical explorations of human strengths. Thousand Oaks, CA: Sage.
5. Snyder, C. R., & Lopez, S. (Eds.). (2002). Handbook of positive psychology. New York: Oxford University Press.

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in on online platform.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	**Humanities & Liberal Arts**
2. Course Code	**LAF481**
3. Course Title	**Application of Psychology**
4. Credits (L:T:P:C)	**3:0:0:3**
5. Contact Hours (L:T:P)	**3:0:0**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Humanities & Liberal Arts**

Course Summary

This course will introduce students about knowledge in the various domains of psychology and its applications. It also includes theories of self, work motivation, job satisfaction, attitude and stress and its management.

Course Objectives

The purpose of this course is to develop a broad base of knowledge in the various domains of psychology and its applications. This course is also about to synthesis and demonstrates of useful skills in the field of psychology namely areas of organization, society, stress management etc.

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

a. The students will be able to understand basic concepts of psychology in major domains.
b. The students will be able to apply the fundamentals of psychology in order to solve real life problems.
c. The students will Use scientific reasoning to interpret psychological phenomena.
d. To apply ethical standards to evaluate psychological science and practice

Curriculum Content

Unit 1: Role of Psychology in Understanding the Self

Three Stages – Self-awareness, Self-acceptance and Self-realization; Exploration through JOHARI Window; Development of Self-Mead & Cooley

Unit 2: Application of Psychology at Work Place

Work Motivation: Theories and applications: Maslow, Herzberg, Goal Setting, Emotion: Emotional Quotient & Job Satisfaction, Early approaches to leadership, contemporary approaches to leadership-Transformational & Transactional Leadership, styles of leadership

Unit 3: Application of Psychology in Personal & Professional Excellence

Achieving Success: Creativity & Innovation; Role of attitude; Role of competence; Role of Self-confidence; Time management; Role of Human Values

Unit 4: Role of Psychology in Health & Fitness

Stress & Coping Strategies: Meaning, Types, Sources, Effects of stress on health, and coping strategies; Characteristics of a healthy personality

Textbook(s)

1. R. Bayne, and I. Horton, Applied Psychology, Sage publications, 2003.
2. A. Furnham, The Psychology of Behaviour at Work, Psychology Press, 1997.
3. D. Harris, Engineering Psychology and Cognitive Ergonomics, Aldershot: Ashgate, 1997

Reference Books

1. Baron, R.A. and Misra, G., Psychology (Indian Subcontinent Edition). Person Education Ltd. (2014).
2. Ciccarelli, S.K. & Meyer, G.E., Psychology (South Asian Edition). New Delhi: Tata Mc Graw Hill. (2008).
3. Passer, M.W., Smith, R.E., Holt, N. and Bremmer, A., Psychology: The Science of Mind and Behavior, McGraw-Hill Education, UK. (2008).
4. R. Gifford, (Ed.), Applied psychology: Variety and opportunity, Allyn and Bacon, 1991.
5. M.L. Blum, and J.C. Naylor, Industrial Psychology, CBS Publishers & Distributors, 1984.
6. D.M. Pestonjee, Stress and Coping: The Indian Experience, 2nd ed., Sage Publications, 1999.

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded on online platform.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1	**Department offering the course**	**Humanities & Liberal Arts**
2	**Course Code**	**LAF282**
3	**Course Title**	**Human Values**
4	**Credits (L:T:P:C)**	**3:0:0:3**
5	**Contact Hours (L:T:P)**	**3:0:0**
6	**Prerequisites (if any)**	**NIL**
7	**Course Basket**	**Humanities & Liberal Arts**

COURSE SUMMARY

This course will introduce students to the nature of the individual and the relationship between the self and the community. It includes Principles of Interdependence between individuals and society and role of material values in promoting human well-being. It also includes psychological and spiritual values through topics like Humanistic Psychology, religion, concept of Dharma and Spirituality morality, Professional values and developing an open and balanced mind.

COURSE OBJECTIVES

To inculcate the skills of ethical decision making and then to apply these skills to the real and current challenges of the Engineering profession. The main objective of the course is to enable the students to understand the need and importance of value-education and education for Human Rights. It also aims to develop their inter personal and leadership skills and empower them to develop into evolved human beings.

COURSE OUTCOMES

On successful completion of the course, students will be able to achieve the following:

1. Students will become more sensitive to their surroundings including both people and nature, with commitment towards what they believe in (human values).
2. Be able to understand how universal values can be uncovered by different means, including scientific investigation, historical research, or public debate and deliberation (what some philosophers call a dialectic method).
3. They will become more aware of their self and their relationships and have better reflective and discerning ability.
4. Be able to understand and discuss the idea of moral relativism and the challenges it poses to universal values.

CURRICULUM CONTENT

Unit 1 INTRODUCTION

Nature of Value-Crisis in the contemporary Indian society, Meaning, Nature & Types of Values; Sources of Value Formation, Foundational Human Values – Integrity, Freedom, Creativity, Morals, Love and Wisdom, Case Studies Case Studies on the above aspects

Unit 2 SOCIETAL VALUES & MATERIAL VALUES

Definition of Society, Units of Society, and Social Consciousness. Concepts & Principles of Interdependence, Conceptualizing 'Good Society' and 'Social Goods' and Corporate Social Responsibility, Role of Material Values in promoting Human Well-being. Role of Science and Technology; Problems of Material Development, Case Studies Case Studies on the above aspects

Unit 3 PSYCHOLOGICAL & SPIRITUAL VALUES

Humanistic Psychology; Concept of Intelligence, Emotional Intelligence & Mental health; Cognitive Dissonance & Ego Defense, Maslow's Hierarchy of Human Need; Characteristics of 'Self-Actualizing' persons; Understanding Common Religion & Concept of Dharma and Spirituality; Case Studies Case Studies on the above aspects

Unit 4 PSYCHOLOGICAL & SPIRITUAL VALUES

Bases for moral Judgments: Customary Morality, Religious Morality, Reflective Morality. Concept of Professional values: Competence , Confidence , Devotion to Duty, Efficiency , Accountability , Respect for learning / Learned , Willingness to Learn, Open and Balanced mind; Team spirit ; Willingness for Discussion, Aims, Effort , Avoidance of Procrastination and Slothfulness, Alertness, IEEE; Case Studies Case Studies on the above aspects

Textbook(s)

1. Human Values - Prof. A.N. Tripathi New Age International, 2009

Reference Books

1. Human Values and Professional Ethics - Jayshree, Suresh and B.S. Raghwan , S. Chand Publication, 2011-12

Teaching and Learning Strategy

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

Approved by the Academic Council at its 17th Meeting held on 24.03.2021

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1	**Department offering the course**	**Humanities & Liberal Arts**
2	**Course Code**	**LAF283**
3	**Course Title**	**Literature, Language & Society**
4	**Credits (L:T:P:C)**	**3:0:0:3**
5	**Contact Hours (L:T:P)**	**3:0:0**
6	**Prerequisites (if any)**	**NIL**
7	**Course Basket**	**Humanities & Liberal Arts**

COURSE SUMMARY

This course will introduce students about the literature, language & society. It also includes the overview of aspects of literature and language with its impact on the society. The course explores the dimensions of literature, its nature and its functions with its approaches to the study of society. It explores the role of language and literature in the society. The course will through study of text, also analyse the practical aspect of it.

COURSE OBJECTIVES

The main objective of the course is to focus is on the interaction between literature & Society, and Literature and visual culture. This course is also about how Literature reacts to major changes in society. This course offers the students to experience different dimension of literature and language.

COURSE OUTCOMES

On successful completion of the course, students will be able to achieve the following:

1. Students will read critically from a variety of genres, specifically poetry, drama, non-fiction, and fiction.
2. Students will read literature more carefully and meaningfully, practicing close-reading skills.
3. Students will understand the relation between historical and cultural contexts.
4. The students will develop a critical understanding of how literature can both uphold and resist existing structures of power.

CURRICULUM CONTENT

Unit 1:

Nature and Functions of Literature, Literature and Society with special reference to Indian Literature and Indian Society, Literary Forms, Poetry, Drama, Fiction, Essay, Autobiography

Unit 2:

Approaches to the Study of Literature, Reader response to the study of Literature, Interpretation, Appreciation, Evaluation, Special problems in understanding Modern Literature.

Unit 3:

Social dimension of language. problems of multilingual communities, dominance and conflict, shift and attrition, language and the state, language and nation, Indian multilingualism, language variation, language and identity, linguistic prejudice and inequality, standardization, linguistic determinism, critical discourse analysis, and methodological issues.

Unit 4:

Jerome K Jerome: Three Men on a Bummel (selection), Martin Amis: Last Days of Muhammad Atta, Li Ho: A Girl Comb her hair, R.K. Narayan: Malgudi Days (selection)

Textbook(s)

1. Jerome K Jerome: Three Men on a Bummel (selection), Arrow smith Publications.

2. R.K. Narayan: Malgudi Days (selection), I*ndian Thought Publications.*

Reference Books

1. Martin Montgomery, An Introduction to Language and Society (Studies in Culture and
   Communication) Routledge; 2 edition (December 22, 1995).
2. Robe Pope, *An Introduction to Language Literature and Culture*. Routledge, 2005.

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded on online platform.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1	**Department offering the course**	**Humanities & Liberal Arts**
2	**Course Code**	**LAF284**
3	**Course Title**	**Principles of Management**
4	**Credits (L:T:P:C)**	**3:0:0:3**
5	**Contact Hours (L:T:P)**	**3:0:0**
6	**Prerequisites (if any)**	**NIL**
7	**Course Basket**	**Humanities & Liberal Arts**

COURSE SUMMARY

This course will introduce students about the basic Principles needed for management. It also includes case studies where a student can get idea about the actual working of the management field. Topics include Overview of Management, Management Information, and Planning Approach to Organizational Analysis, Motivation and Productivity.

COURSE OBJECTIVES

The objective of this course is to familiarize B.Tech. Students with the roles, responsibilities, and skills required of modern managers. This course will be present the concepts of management as it applies to current thinking in the workplace.

COURSE OUTCOMES

On successful completion of the course, students will be able to achieve the following:

1. To present the topics in management, management theories, while at the same time focusing on practical applications in the real world especially for engineers.
2. Evaluate the global context for taking managerial actions of planning, organizing and controlling.
3. Assess global situation, including opportunities and threats that will impact management of an organization.
4. Integrate management principles into management practices.

Curriculum Content

Unit 1 Overview of management

Definition-Management-Role of managers-Organization and the internal and environmental factors –Trends and Challenges of Management in India.
Directing – delegation –span of control– communication, Controlling

Unit 2 Management Information

Introduction to functional areas of management, Operations management, Human

resources management, Marketing management, Financial management

Unit 3 Planning Approach to Organizational Analysis

Design of organization structure; job design and enrichment; job evaluation and merit rating

Unit 4 Motivation and Productivity

Theories of motivation, Leadership styles and Managerial grid. Co-ordination, monitoring and
control in organizations. Techniques of control; Few Cases on current management issues in India

TEXT BOOKS:

1. Schermerhorn, Management and Organisational Behaviour essentials, Wiley India
2. Koontz: Essentials of Management, PHI Learning.
3. Hirschey: Managerial Economics, Cengage Learning.
4. A V Rau: Management Science, BSP, Hyderabad
5. Mote, l Paul and Gupta: Managerial Economics Concepts & Cases, TMH, New Delhi.

6. Stephan R Robbins Fundamental of Management, Pearson

REFERENCE BOOKS

1. Koontz, H., and Weihrich, H., Essentials of Management: An International Perspective, 8th ed., McGraw Hill, 2009.
2. Hicks, Management: Concepts and Applications, Cengage Learning, 2007.
3. Mahadevan, B., Operations Management, Theory and Practice, Pearson Education Asia, 2009
4. Kotler, P., Keller, K.L, Koshy, A., and Jha, M., Marketing Management, 13th ed., 2009.
5. Khan, M.Y., and Jain, P.K., Financial Management, Tata-Mcgraw Hill, 2008.

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded on online platform.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	**Humanities & Liberal Arts**
2. Course Code	**LAF482**
3. Course Title	**Intellectual Property Rights**
4. Credits (L:T:P:C)	**3:0:0:3**
5. Contact Hours (L:T:P)	**3:0:0**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Humanities & Liberal Arts**

COURSE SUMMARY

The course offers a comprehensive intellectual property subject that is easy to understand for students. The intellectual property rights syllabus comprises topics ranging from patent registration to copyrights and trademarks, and examples are based on familiar situations that the students encounter in their day-to-day lives. Topics would include the major aspects of IPR, which include analysing an idea, patent search techniques, which also helps them to boost their career with additional industry-relevant skills.

COURSE OBJECTIVES

The purpose of this course is to provide the basic understanding of intellectual property rights, the rationale behind making provision for these rights and the recent concerns in the field. The main objective of the course is to increase the attention of students to protect their IP though legal provision and also teach the students how they can reduce the imitation rate. This course also helps to teach the students the understanding their involvement in technology transfer and commercialization.

COURSE OUTCOMES

On successful completion of the course, students will be able to achieve the following:

1. The students will be able to understand the importance of IPRs in academic field.
2. The student gets idea how they can protect their IP through IPRs regime.
3. The student gets more incentive towards technology transfer and commercialization
4. Apply intellectual property law principles (including copyright, patents, designs and trademarks) to real problems and analyse the social impact of intellectual property law and policy

CURRICULUM CONTENT

Unit 1: Introduction to IP

Public Funded Research and Its Implications in an Economy; Public Funded Research and Economic Development; Research & Development and Industrial Development

Unit 2: Historical Perspectives of IPRs
History and concept of Property; Introduction to intellectual property rights (IPRs); Patent, Industrial design; Copyrights, Trademarks, Geographical Indications; Trade Secrets; International aspect of IPRs; Development at International level regarding IPRs

Unit 3: Polices on IPRs in India
The debate: Copyright vs Copy left; Research ethics; role of IPRs in economic development in developed and developing economies; Overview of Various Policies on IPRs in India; Success Story of Bayh Dole Act of IPRs in USA

Unit 4: IPRs and Technology Commercialization
Technology Transfer and Commercialization; Key Determinants and Participants of Technology Transfer and Commercialization; Types of Technology Transfer and Commercialization; Technology Transfer and Commercialization in India and Other Developing Economies

Textbook(s)

1. Cornish, W.R. and L. David. 2010. 7th Edition. Intellectual Property: Patents, Copyrights, Trademarks and Allied Rights. Sweet and Maxwell.

2. Narayan, P. 2002. Intellectual Property, Law in India, 3rd Ed. New Delhi, Delhi Law House.

3. Ganguli, P. 2001. Intellectual Property Rights: Unleashing the Knowledge Economy. Tata McGraw Hills.

4. Watal, J. 2001. Intellectual Property Rights in the WTO and Developing Countries. New Delhi: Oxford University Press.

Reference Books

1. Singh A.K., Ashraf S.N. and Acharya S.R. 2017. Viability of Bayh Dole Act of USA in the context of India: Critical evidence from review of literature, in Sasi Misra.
2. Sunil Shukla and Ganapathi Batthini (Eds). Proceedings of the 12th Biennial Conference on Entrepreneurship Organized by EDII Ahmedabad (pp. 235-252). Bookwell Publishing House: New Delhi

Teaching and Learning Strategy
All materials (ppts, assignments, labs, etc.) will be on online platform.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1	**Department offering the course**	**Humanities & Liberal Arts**
2	**Course Code**	**LAF382**
3	**Course Title**	**Engineering Economics**
4	**Credits (L:T:P:C)**	**3:0:0:3**
5	**Contact Hours (L:T:P)**	**3:0:0**
6	**Prerequisites (if any)**	**NIL**
7	**Course Basket**	**Humanities & Liberal Arts**

COURSE SUMMARY

The course is devoted to teach basic concept of economics to the student of engineering. This includes basic concept of demand and supply of goods and services. Break-even point and evaluation is also included in this subject. Project evaluation and depreciation of physical assets are also key contribution in this subject. Finally, few concepts of banking system, inflation and business cycle are also the vital topics in this subject.

COURSE OBJECTIVES

To provide the basic overview of economics in engineering perspectives.

To increase the understanding of students to solve the engineering problems through economic theories.

To increase the understanding of students to use economics theories in project investment of industries

COURSE OUTCOMES

On successful completion of the course, students will be able to achieve the following:

1. Students will be able to apply economic principles and calculations to solve engineering projects.
2. To students will be efficient to get the idea of production activities and its applications in industries.
3. Students will be competent to estimate the present and future value of money on their various investment plans.
4. Develop the ability to account for time value of money using engineering economy factors and formulas, as well as the implications and importance of considering taxes, depreciation, and inflation.

CURRICULUM CONTENT

Unit 1 General Overview of Economics

Nature and Scope of Economics in engineering perspective; **Theory of Demand Analysis:** Meaning and Types, Law of demand, Exceptions to the Law of Demand, Elasticity of Demand; **Theory of Supply Analysis:** Law of Supply and Elasticity of Supply; Mathematical Explanation on cost, revenue and profit function

Unit 2 Production Function and Its Applications

Production Function: Short-run and long-run Production Function; **Mathematical Explanation:** Laws of Returns to Scale & Law of Diminishing Returns Scale; **Concept of Cost and Its Types:** Total cost, fixed cost, variable cost, average variable cost, average fixed cost, marginal cost, explicit and implicit cost; **Break-Even-Analysis:** Importance and graphical presentation, mathematical problems

Unit 3 Time Value of Money and Project Evaluation

Time Value of Money: Simple and Compound, Uniform Series Compound Interest Formula, Present Worth Analysis, Future Worth Analysis, Future Value through Annuity, Rate of Return Analysis, Cash flow diagrams; **Depreciation**: Introduction, Straight Line and Declining Balance Method of Depreciation; **Project Evaluation Techniques:** Present Worth Method, Future Worth Method, Annual Worth Method; Benefit Cost Analysis: Conventional and Modified B/C Ratio with PW method

Unit 4 Banking and Finance

Banking Sector: Functions of the Commercial Bank and Central Bank, Financial Institutions; **Financial Market:** Money Market and Capital Market; **Monetary and Fiscal Policy:** Objectives, Instruments, Tools in Indian Economy; **Inflation:**Causes, Effects and Methods to Control it, Measurement of Inflation- Consumer Price Index and Whole Price Index; Deflation and Stagflation; **Business Cycles:** Various phases, Control and Measurement, Impact on business cycles on economic activities

TEXT BOOKS TEXT BOOKS

1. Pravin Kumar (2015). Fundamental of Engineering Economics. Raj Kamal Press, New Delhi.

2. Riggs J.L., Dedworth, Bedworth D.B., and Randhawa, S.U. (1996). Engineering Economics. McGraw Hill International, New Delhi

3. Panneer Selvam R. (2001). Engineering Economics. Prentice Hall of India Ltd, New Delhi.

REFERENCE BOOK

1. L.M. Bhole (2007). Financial Institutions and Markets. Tata McGraw Hill, New Delhi.

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded on online platform.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	**Humanities & Liberal Arts**
2. Course Code	**LAF287**
3. Course Title	**Sustainable Development**
4. Credits (L:T:P:C)	**3:0:0:3**
5. Contact Hours (L:T:P)	**3:0:0**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Humanities & Liberal Arts**

COURSE SUMMARY

This course will introduce students about the basic Principles needed for management. It also includes case studies where a student can get idea about the actual working of the management field. Topics include Overview of Management, Management Information, and Planning Approach to Organizational Analysis, Motivation and Productivity.

COURSE OBJECTIVES

To provide the overview of sustainable and its needs to the students.
To provide the importance and components of sustainable development to the students.
To provide the association of social and economic development to the students

COURSE OUTCOMES

1. Students will get the importance of natural resource in economic development.
2. Students also would be able to sophisticated concept of sustainable development.
3. Students would be able to contribute significant efforts towards sustainable development.

CURRICULUM CONTENT

Unit 1: Overview of Sustainable Development

History and emergence of the concept of Sustainable Development, Components of SD i.e., Economic, Social, Human, Institutional, Technological and Environmental development; Definitions, Sustainability in Ecosystem Services; natural resource degradation, greenhouse gases, factors affecting SD (i.e., Industrialization, urbanization, population growth, globalization, etc.).

Unit 2: Polices on Sustainable Development at international level

Government Policies for SD in India; Socio-economic policies for sustainable development in India, Sustainable development through trade, Carrying Capacity, global policies for sustainable development.

Unit 3: Sustainable Development and International Contribution

SDGs and MDGs, Complexity of growth and equity, International Summits, Conventions, Agreements, Initiations of international organizations like WHO, UNDP, WTO, FAO and World Bank towards sustainable development.

Unit 4: Measurement of Sustainable Development

Role of developed and developing countries in the sustainable development, Demographic dynamics and sustainability, integrated approach for resource protection and management; Index based estimation of SD i.e., Environmentally Sustainable Development Index and sustainable development, and another index.

TEXT BOOKS:

1. The Sustainability Revolution: Portrait of a Paradigm Shift by Edwards, Andres R., New Society Publishers, 2005.

REFERENCE BOOKS

1. The Sustainability Revolution: Portrait of a Paradigm Shift by Edwards, Andres R., New Society Publishers, 2005.
2. Sustainable development in India: Stocktaking in the run up to Rio+20: Report prepared by TERI for MoEF, 2011.

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded on online portal.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	**Humanities & Liberal Arts**
2. Course Code	**LAF286**
3. Course Title	**Youth Psychology**
4. Credits (L:T:P:C)	**3:0:0:3**
5. Contact Hours (L:T:P)	**3:0:0**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Humanities & Liberal Arts**

COURSE SUMMARY

This course will introduce students about the youth, identity and development related issues. The course explores the risk factors of a youth such as education. It explores the development of youth in the society. The course will through study of text, also analyse the practical aspect of it.

COURSE OBJECTIVES

To help students understand the notion of youth, youth across cultures, the factors influencing youth identity and sensitivity to issues concerning the youth of today.

COURSE OUTCOMES

On successful completion of the course, students will be able to achieve the following:

1. Students will get to know about concepts of youth, youth identity.
2. Students will learn about the process of youth development and relationship.
3. Students will learn to how a youth could develop on his own.
4. Students will learn about relevance of positive virtues during young age.

CURRICULUM CONTENT

Unit 1: Introduction

Defining youth; Youth across cultures**;** Formulation of youth identity**;** Concerns of youth in Indian context.

Unit 2: Youth development and Relationships

Relationship with family members and friends**;** Romantic relationships**;** Youth culture: Influence of globalization, identity crisis

Unit 3: Today's Youth: Issues and challenges

Youth and risk behaviours; Employment and education

Unit 4: Developing Youth

Positive youth development**;** Building resources: Hope, Optimism and Resilience

Textbook(s)

1. Robbins, S. P. & Judge, T.A. (2008).Essentials of Organizational Behavior.9th

Edition. New Delhi: Prentice Hall of India.
2. Adler, N.J. (1997). Global leaders: Women of influence. In G. N. Powell (Ed.), Handbook of Gender and Work, (239-261). Thousand Oaks, CA, US: Sage Publications, Inc.

Reference Books

1. Adler, N.J. (1997). Global Leaders: A Dialogue with future history. Journal of International Management, 2, 21-33.
2. Chadha, N.K. (2007). Organizational Behavior (1st Edition). Galgotia Publishers: New Delhi.
3. Greenberg, J. & Baron, R.A. (2007). Behaviour in Organizations (9th Ed.). India: Dorling Kindersley
4. Griffin, R.W. & Moorhead, G. (2009). Organizational Behavior: Managing People & Organizations (11th Edition). Biztantra publishers

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded on the online platform. Refer to your course for details.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	**Humanities & Liberal Arts**
2. Course Code	**LAF383**
3. Course Title	**Introduction to Linguistics**
4. Credits (L:T:P:C)	**2:0:2:3**
5. Contact Hours (L:T:P)	**2:0:2**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Humanities & Liberal Arts**

COURSE SUMMARY

The student will be able to comprehend foundational linguistic concepts and their relation with the human mind. They will understand how research in linguistics can be used to address real world problems.

COURSE OBJECTIVES

To introduce the basic concepts in areas of linguistics, syntax, morphology, phonetics, and phonology and the interaction between them.

To provide an understanding of the main communicative functions of language, and the formal ways to achieve them.

COURSE OUTCOMES

On successful completion of the course, students will be able to achieve the following:

1. The student will be able to apply the basic concepts of linguistics, syntax, morphology, phonetics, and phonology
2. The student will be able to appreciate the use of basic concept of linguistics.

CURRICULUM CONTENT

Unit 1:
(10)

Linguistics and its Scope, Branches of Linguistics, Some basic concepts in Linguistics, Language and Communication

UNIT 2
(16)

Language Structure Sassure's concept of Linguistic sign, Langue and Parole; Syntagmatic and Paradigmatic relations, Synchronic and Diachronic studies; Chomsky – Competence and Performance; Language Variation and Language Change

UNIT 3
(15)

Phonetics and Phonology; Phoneme, Allophone, Human Speech Mechanism, Vowels and Consonants in English Syllable structure, Phonemic Transcription, Supra-segmental features, Neutralization of MTI

UNIT 4
(11)
Morphology and Syntax; Morpheme, Word Formation Processes in English, Roots, prefix & suffix

Text book [TB]:

1. Halliday, Michael A.K.; Jonathan Webster (2006). On Language and Linguistics. Continuum International Publishing Group. p. vii. ISBN 978-0-8264-8824-4.
2. Rens Bod (2014). A New History of the Humanities: The Search for Principles and Patterns from Antiquity to the Present. Oxford University Press. ISBN 978-0-19-966521.

Reference books [RB]:

1. Delany, Sheila. The Naked Text: Chaucer's Legend of Good Women. Berkeley: University of California Press, 1994.

2. Mc Alpine, Monica. The Genre of Troilus and Criseyde. Ithaca: Cornell University Press, 1978.
3. Brooks, Cleanth. The Language of Paradox: 'The Canonization' John Donne: A Collection of Critical Essays. Ed. Helen Gardner. Englewood Cliffs, N. J.: Prentice Hall, 1962.

Teaching and Learning Strategy
All materials (ppts, assignments, labs, etc.) will be uploaded on online platform.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

Skill Enhancement (min 12 credits to be taken)

1. Department offering the course	**Mechanical Engineering**
2. Course Code	**MEF104**
3. Course Title	**Workshop Practices**
4. Credits (L:T:P:C)	**0:0:4:2**
5. Contact Hours (L:T:P)	**0:0:4**
6. Prerequisites (if any)	**NA**
7. Course Basket	**Skill Enhancement Course**

COURSE SUMMARY

Ability to prepare simple objects using machines and machine tools to make students aware of fundamental operations of manufacturing an engineering component, enhance visualization and motivate them to innovate.

COURSE OBJECTIVES

To familiarize with the basic manufacturing processes and to study the various tools and equipment.

They will get hands-on training is given in different sections. Essentially student should know the labour involved, machinery or equipment necessary.

To analyze time required to fabricate and also should be able to estimate the cost of the product or job work.

COURSE OUTCOMES

On successful completion of the course, students will be able to achieve the following:

1. Have Capability to identify hand tools and instruments for machining and other workshop practices.
2. Obtain basic skills in the trades of fitting, carpentry, welding and machining.
3. Acquire measuring skills, using standard workshop instruments & tools.
4. Gain eye hand co-ordination; enhance psycho motor skills and attitude.

CURRICULUM CONTENT

UNIT 1: Machine Shop

To make a machined-component using lathe with mild steel round bar or hexagonal bar comprising of common turning operations with reference to drawing given in the manual.

Any one of the following jobs

Jobs: Hex Bolt, Axle for cycle wheel, Jig Bush, a typical turning specimen.

UNIT 2: Sheet metal Shop

To make a sheet metal component with galvanized iron sheet as per the drawing provided in the manual having spot welding joint.

Any one of the following jobs

Jobs: Square tray, Scoop, Funnel

Fitting Shop

To make a joint using fitting tools with mild steel flats, round bars or square bars as per

the drawing provided in the manual.

UNIT 3: Welding Shop- Arc Welding

To prepare a welding joint with mild steel flat using Manual Metal Arc welding machine according to the drawing provided in the manual.

Any one of the following jobs

Jobs: Lap joint, Butt joint, Fillet/Corner joint

Gas & Spot Welding

To observe the demonstration of making a Lap joint/Butt joint with mild steel sheet using oxyacetylene flame as per the drawing provided in the manual. To perform the spot welding operation on G.I. Sheet.

UNIT 4: Carpentry Shop

To make a wooden joint with soft wood as per the drawing provided in the manual.

Any one of the following jobs

Jobs: T-Lap joint, Dove tail joint, Mortise & Tendon joint, Bridle joint.

UNIT 5: Foundry Shop

Introduction to foundry process like melting of metals, mould making, casting process and use of patterns to prepare of a component and significance of foundry.

Demo of mould preparation.

Minor Project:

To make a minor project by the students in batches comprising the operations performed in different shops

Textbook(s)

1. A course in Workshop Technology Vol I and Vol II by Prof. B.S. Raghuwanshi Dhanpat Rai & Co.(P) Ltd.
2. Elements of Workshop Technology Vol I and Vol II by S.K. Hajara Choudhury, A.K. Hajara Choudhury & Nirjhar Roy; Media Promoters & Publishers Pvt. Ltd, Mumbai

Reference Books

1. Workshop Technology Part 1 , Part2 & Part3 by W.A.J. Chapman; CBS Publishers & Distributors, New Delhi

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	**Mechanical Engineering**
2. Course Code	**MEF102**
3. Course Title	**Engineering Graphics**
4. Credits (L:T:P:C)	**2:0:4:4**
5. Contact Hours (L:T:P)	**2:0:4**
6. Prerequisites (if any)	**N.A**
7. Course Basket	**Skill Enhancement Course**

COURSE SUMMARY

This course enables the students to use engineering graphics skills as a means of recording and transmitting technical information and ideas from one mind to another. It communicates all needed information of things that are to be built or manufactured.

COURSE OBJECTIVES

To learn the rules/ standards in writing titles, dimensions, notes and drawing particulars on drawing sheet with the help of drawing instruments.
To learn the purpose and types of scales used in Engineering Drawing.
To learn the methods of constructing various geometrical figures and their applications.
To learn various methods of projections and improve the visualization skills before projecting two-dimensional views of any object.
To study various shapes of solids and learn to create their sectional views.
To learn about developing lateral surfaces of various solids.
To develop skills in drawing three dimensional view of any object and understand the basic AutoCAD commands.

COURSE OUTCOMES

On successful completion of the course, students will be able to achieve the following:

1. Acquire requisite knowledge, techniques and attitude of engineering drawing.
2. Able to read and interpret object drawings.
3. Able to visualize accurately and effectively for drawing orthographic/ isometric projections of any object.

Curriculum Content

UNIT 1: Introduction to Engineering Graphics

Introduction to drawing instruments, layout and sizes of drawing sheets and drawing boards, Title blocks, different types of lines used in engineering drawing as per BIS specifications, lettering (Alphabet and numerals) – upper case (Capital Letter), single stroke, vertical and inclined at 75 degrees, principles and methods of dimensioning, types of scale, definition of R.F., Drawing of plain and diagonal scales, Construction of regular polygons, circles and ellipses.

UNIT 2: Projections of Points and lines

Theory of orthographic projections, Projection of Points in different quadrants.
Projections of Straight Line– parallel to both the planes, parallel to one plane and perpendicular/ inclined to other. Line inclined to both HP and VP.

UNIT 3: Projections of Planes and Solids
Projections of different lamina (plane) like square, rectangular, triangular and circle parallel/ inclined to one plane and perpendicular to another plane.
Projections of solids in simple position - with axes inclined to one reference plane and parallel to other. Projections of solids with axes inclined to both the reference planes.

UNIT 4: Section of Solids and Development of Surfaces
Introduction to Sectioning, Sectioning of solid like cube, prism, pyramid, cylinder and cone, True shape of a section.
Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone. Development of the lateral surfaces of truncated solids.

UNIT 5: Isometric Projection and Auto CAD
Basics of isometric projections and isometric scale, Isometric views of simple solids – cube, prisms, pyramids, cylinder and cone. Conversion of Orthographic Views into isometric Views, Basic AutoCAD commands & their applications.

Textbook(s)

1. N. D. Bhatt and V.M. Panchal, "Engineering Drawing", Charotar Publishing House Pvt. Ltd., 53rd edition, 2016 reprint.
2. P.S. Gill, "Engineering graphics", S. K. Kataria& Sons, 13th edition, 2016.

Reference Books

1. Agarwal B. and Agarwal C.M, "Engineering Drawing", Tata McGraw Hill Publishing Co. Ltd., N. Delhi.
2. K. Venugopal and V. Prabhu Raja, "Engineering Graphics", New Age International Private Limited.
3. D.M. Kulkarni, A.P. Rastogi, A.K. Sarkar, "Engineering Graphics with AutoCAD", PHI Learning Pvt. Ltd.
4. G.S. Phull and H.S. Sandhu, "Engineering Graphics", Wiley Publications.

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	**Mathematics**
2. Course Code	**MAF346**
3. Course Title	**TECHNICAL WRITING WITH LATEX – I**
4. Credits (L:T:P:C)	**0:0:4:2**
5. Contact Hours (L:T:P)	**0:0:4**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Skill Enhancement Course**

COURSE OBJECTIVE

The objectives of this lab are to

- Install and basic handling of the software.
- Teach the basics of LaTeX.
- Introduce advanced techniques for writing mathematics.
- Introduce advanced techniques for editing and formatting documents, preparing large documents such as
- Use of LaTeX in daily academic and official work.

Course Pre/Co- requisite (if any) : no restricted pre-requisite

COURSE OUTCOME

After successful completion of the workshop, participants will be able to :

1. execute typesetting of journal articles, technical reports, thesis, books, and slide presentations.
2. control over large documents containing sectioning, cross-references, tables and figures.
3. typesetting of complex mathematical formulae.
4. advanced typesetting of mathematics with AMS-LaTeX.
5. automatic generation of table of contents, bibliographies and indexes.

Contents to be covered

1. Installation of LaTex and editors.
2. Introduction of LaTex and different editors.
3. Basic and advanced document typesetting.
4. Mathematical equation typing and editing.
5. Inclusion of figures and tables.
6. Preparation of bibliography.
7. Typesetting of Journal articles, Technical reports, Thesis, Books.
8. Slide preparation using Beamer.

Text Books:

1. Laslie Lamport, LaTeX: A Document Preparation System (2nd Edition), 1994

Reference Books:

1. George Gratzer, Practical LaTeX, Springer, 2014.

1. Department offering the course	Mathematics
2. Course Code	MAF119
3. Course Title	Introduction to MATLAB
4. Credits (L:T:P:C)	2:0:2:3
5. Contact Hours (L:T:P)	2:0:2
6. Prerequisites (if any)	None
7. Course Basket	Skill Enhancement Course

Course Summary:

Course Objective:

The objective of this course is to introduce the students with basics of MATLAB, curve plotting and use of basic commands to solve various algebraic and differential equations through MATLAB.

Course Outcomes:

After successful completion of this course students will be able to:

- Understand the basics functions of MATLAB.
- Plot the 2D, 3D figures.
- Use basic commands of MATLAB.
- Solve various differential equations using MATLAB.

Curriculum Content:

Unit I

Introduction to MATLAB: vector and matrix generation, subscripting and the colon notation, matrix and array operations and their manipulations, introduction to some inbuilt functions related to array operations. m-files: scripts and functions, editing, saving m-files, and interaction between them.

Unit II

Two & three-dimensional graphics: basic plots, change in axes and annotation in a figure, multiple plots in a figure, saving and printing figures, mesh plots, surface plots and their variants.

Unit III

Relational and logical operators: flow control using various statements and loops including If-End statement, If-Else-End statement, nested If-Else-End statement, For-End and While-End loops with Break commands.

Unit IV

Introduction to builtin functions: related to matrix inversion, eigenvalues, eigenvectors, condition number; for data representation: bar charts, histograms, pie chart, stem plots etc; for solving various type of differential equations; for specialized plotting e.g., contour plots, sphere, and animations.

Text Books

1. Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers by Rudra Pratap, Oxford University Press.

Reference Books

1. Applied Numerical Methods with Matlab for Engineers and Scientists by Steven Chapra, McGraw Hill.

2. MATLAB: An introduction with applications: Amos Gilat, 5th Edition, Wiley India.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1	**Department offering the course**	**Maths and Career Development Centre**
2	**Course Code**	**MAF256**
3	**Course Title**	**Aptitude and Skill Enhancement- I**
4	**Credits (L:T:P:C)**	**3:0:0:3**
5	**Contact Hours (L:T:P)**	**3:0:0**
6	**Prerequisites (if any)**	**NIL**
7	**Course Basket**	**Skill Enhancement Course**

COURSE SUMMARY

This module is focused on providing students hands-on practice on aptitude problems and prepare a stronger fundamental base for Aptitude and Soft Skills capabilities.

COURSE OBJECTIVES

Prepare a ground for the students to be ready in Quantitative, Logical Aptitude and Verbal Aptitude

Prepare them for becoming confident and corporate-culture fit as present-day workplace requires professionals who are not only well qualified and competent but also possess Soft Skills like interpersonal skills and good presentation skills.

COURSE OUTCOMES

On successful completion of the course, students will be able to achieve the following:

1. Develop Leadership & Team Building Skills.

2. Receive hands-on guidance to develop an effective CV.

3. The students would be able to understand the basic trends of questions asked in the aptitude part of placements.

Curriculum Content

UNIT 1: APTITUDE (Quantitative and Logical)

Progression, logarithm, Quadratic Equations (concept of determinant, real, non-real, rational and conjugate roots); Mensuration

Input Output – Sequential output tracing of logical operations applied on machine input, Ranking and Order- Test - Ordering of measurable attributes like height / weight / performances, etc.

Eligibility test, Logical sequences and series, Completion of incomplete pattern, Odd figures

UNIT 2: VERBAL APTITUDE

Tenses and Grammar drills.

Creative Writing: Essay, Report Writing, Article, Letters, E-mail: difference between formal and informal tone, appropriate use of transition words, creating a signature, understanding different situations and the responses they require (situation- based writing), Proper use of connectors.

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UNIT 3: LEADERSHIP & TEAM BUILDING SKILLS

Importance, How to develop Leadership Skills? Best Leadership & Team Building Examples.

Suggested Activities & Exercises: (i) Leadership Pizza, (ii) Minefield, (iii) Leaders You Admire.

UNIT 4: PRESENTATION SKILLS

Principles of Effective Presentations, Do's and Don'ts of Formal Presentations, How to prepare for a formal presentation, Presentation Exercises a) Welcome speech, c) Farewell Speech, d) Vote of thanks etc.

Suggested Activities & Games: (i) Stand Up for Fillers, (ii) Mimes, (iii) Short Speech Challenge.

Textbook(s)

1. Quantitative Aptitude: How to prepare for Quantitative Aptitude, Arun Sharma, McGraw Hill, 8th edition-2018.
2. Logical Reasoning: A Modern Approach to Verbal & Non-Verbal Reasoning by R.S. Aggarwal, S Chand Publishing; 2nd Colour edition-2018.
3. Verbal Aptitude: English is Easy- Chetanand Singh, BSC Publication-2018

Reference Books

1. Quantitative Aptitude: Quantitative Aptitude for Competitive Examinations- R.S. Agarwal S. Chand Publications-2018.
   Quantitative Aptitude: Quantitative Aptitude- Saurabh Rawat and Anushree Sah Rawat Savera Publishing House, 1st edition-2016.

2. Logical Reasoning: Analytical & Logical Reasoning by Peeyush Bhardwaj-Arihant Publications; 4th edition-2015.

Logical Reasoning: Analytical Reasoning by M.K.Pandey BSC publishing; 3rd edition -2009.

3. Verbal Aptitude: Oxford Guide to English Grammar- John Eastwood, Oxford University Press-2003.

4. Soft Skills: Talk like Ted – Carmine Gallo, St. Martin's Press.
   Soft Skills: No Excuses – Dr Wayne Dyer, Hay House Inc.

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle / Google drive. Refer to your course on SAP for details.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1	**Department offering the course**	**Maths and Career Development Centre**
2	**Course Code**	**MAF348**
3	**Course Title**	**Aptitude and Skill Enhancement- II**
4	**Credits (L:T:P:C)**	**3:0:0:3**
5	**Contact Hours (L:T:P)**	**3:0:0**
6	**Prerequisites (if any)**	**None**
7	**Course Basket**	**Skill Enhancement Course**

COURSE SUMMARY

The first step of an intensive two step placement training module equips the students to successfully handle the placement program of any on-campus/off-campus company. It not only provides career guidance about the selection process but also helps students in profile building and enhancing their employability skills.

COURSE OBJECTIVES

Interpret the questions of aptitude building objectively and prepare for various competitive examinations

Understand the optimized approach of dealing with placement questions

Learn ways of representing themselves effectively in formal settings

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. By the end of this semester, students will be able to perceive and analyse the requirements of placement trends as detailed information about the selection process would be provided by career guidance.
2. They will be more confident and will be able to develop a professional profile, both online and offline.

CURRICULUM CONTENT

UNIT 1 - QUANTITATIVE APTITUDE

Number System

Types of numbers; Factors; Divisibility test; Place and face Value; Base system; Remainder theorem; digits at the unit places and finding last two digits in a given expression; Calculating number of zeroes, Finding maximum power of any prime number or any composite number in any factorial, HCF and LCM.

Fractions–Types of fractions; Conversion of terminating and non-terminating types of decimal into fraction; Subtraction, addition and multiplication of terminating and non-terminating decimals.

Percentage
Basic concepts; Conversion from fraction to percentage; Application of percentage in – Expenditure, Cost, Consumption problems; Population increase or decrease problems; Production, Manpower and Working hour problems; successive increment or decrement; Comparison of salary or numbers; Percentage change in area or volume, etc.

Ratio and Proportion
Ratio, Proportion and Variation: Ratio- Introduction; Types of ratios; Comparison of Ratios; Concept of duplicate, triplicate, sub-duplicate and sub-triplicate ratios.
Proportion and variation – Concept of direct, inverse, continuous and mean proportions.

Profit and Loss
Introduction; Concept of single, double and triple discount and marked price.
Simple / Compound Interest
Simple Interest and compound Interest: Basic concept of Principal, Time, Amount and Rate of Interest; Concept of Lent money.

UNIT 2- VERBAL APTITUDE

Subject-Verb agreement & Gerunds, Active and Passive voice
Question Types
Introduction to Question types-I: Fill in the blanks, One word Substitution, Spellings, understanding the right word choice, concept of para jumbles and para completion, reading comprehension, verbal analogies, odd man out, phrases and idioms.
Introduction to Question types-II: Error identification, Homophones, Usage of the various figures of speech, commonly confused words and phrases, techniques for tackling synonyms and antonyms.

Reading Comprehensions
Reading Comprehension: Basics of Comprehensions, different tones of comprehensions, cracking question types like contextual vocabulary, fill in the blanks, true/false questions, reference to context, summary and title of the passage, paraphrasing the text.

UNIT 3- LOGICAL REASONING

Coding Decoding and Sequences
Coding Decoding, Crypt arithmetic, Sequence and Series - Finding the missing term/wrong term in the logical sequence of letter/number/word/alphanumeric, Continuous pattern series.

Verbal Analogies and Odd man out
Verbal Analogy based on various parameters - Antonym / synonym relationship, Quantity and unit, Individual and Group, Product and Raw material, cause and Effect etc.
Odd man out based on several kind of relationship – Relationship based on meaning, functional relationship, even- odd or prime-composite, divisibility rule, etc.

Blood Relation and Direction Sense
Blood Relation- Indicating form / puzzle form / coding form, Direction Sense, Direction puzzles.

Seating Arrangements
Seating Arrangements – Linear / Circular / Distribution / comparison/ Floor and box arrangement /Quant based arrangements/ etc.

Critical Reasoning
Statement and assumptions, course of action, statement and conclusion, probably true/false.

UNIT 4- NON VERBAL COMMUNICATION
Types of Non Verbal Communication, Body Language-Exercises and Activities, Error Analysis & Feedback Sharing.

Suggested Activities & Exercises: (i) Communication Origami, (ii) Power of body language, (iii) Draw it.

UNIT 4: EMPLOYABILITY SKILLS & CV WRITING
What Skills Do Employers Expect From Graduates? CV vs. Resume, CV writing Do's & Don'ts, Tips with Best Examples/ Samples, Feedback Sharing & Error Analysis.
Suggested Activities & Exercises: (i) Relevant Videos on 'Employability', (ii) Group Discussions on Newspaper Articles, (iii) Sample correction, (iv) writing exercise.

Textbooks

1. Quantitative Aptitude : How to prepare for Quantitative Aptitude, Arun Sharma, McGraw Hill, 8th edition, 2018.
2. Logical Reasoning **:** A Modern Approach to Logical Reasoning-R.S. Aggarwal, S Chand Publishing; 2nd Colour edition-2018.
3. Verbal Aptitude : English is Easy- Chetanand Singh, BSC Publication-2018.
4. Soft Skills- The Power of Now- Eckhart Tolle, Yogi Impressions Books Pvt. Ltd.-2010.

Reference Books

1. Quantitative Aptitude: Quantitative Aptitude for Competitive Examinations- R.S. Agarwal S. Chand Publications-2018.
   Quantitative Aptitude: Quantitative Aptitude- Saurabh Rawat and Anushree Sah Rawat Savera Publishing House, 1st edition-2016.

2. Logical Reasoning: Logical Reasoning and Data Interpretation for the CAT - Nishit K Sinha; Pearson India; 5th edition-2016.
   Logical Reasoning: Wiley's Verbal Ability and Reasoning - P A ANAND,Wiley -2016.

3. Verbal Aptitude: Fun with grammar- Suzanne W. Woodward Pearson Education ESL-1996.

4. Soft Skills- The Greatness Guide – Robin Sharma, Jaico Publishing House- 2006.

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/Google drive. Refer to your course on SAP for details.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1	**Department offering the course**	**Maths and Career Development Centre**
2	**Course Code**	**MAF349**
3	**Course Title**	**Aptitude and Skill Enhancement- III**
4	**Credits (L:T:P:C)**	**3:0:0:3**
5	**Contact Hours (L:T:P)**	**3:0:0**
6	**Prerequisites (if any)**	**NIL**
7	**Course Basket**	**Skill Enhancement Course**

COURSE SUMMARY

Aptitude and Skill Enhancement-III is the final step of the program and the module is designed to enhance the analytical and interpersonal skills of students to make them ready to face various placements, interviews. It will also help them learn various personality development techniques by enhancing their GD and PI skills. Mock Placement Drive will test and improve students by Feedback Sharing & Error Correction.

COURSE OBJECTIVES

Align themselves with the placement requirements and their needs
Learn analytical and employability skills
Prepare students for job placements so that they could clear the selection process successfully and give them strategies and skills to crack GD as well as PI to get selected with decent job offers

COURSE OUTCOMES

On successful completion of the course, students will be able to achieve the following:

1. Be prepared for the upcoming placements and they will also be ready for other competitive exams.
2. Improve their GD and PI Skills and be able to have firsthand experience of a Placement drive and gain sufficient confidence to perform well.

CURRICULUM CONTENT

UNIT 1: QUANTITATIVE APTITUDE

Time Speed Distance
Introduction & types; Speed, Distance and Time: Average Velocity; Race tracks - Straight and Circular; Trains; Boats and Streams

Time and Work & Partnership
Basic concepts (relationship between men, days and work); Understanding group efficiency; Alternate work; Negative work; Wages; Pipes and Cisterns. Concept of partnership.

Permutation and Combination
Basic Principles of Counting (Addition and Multiplication); Arrangements, circular permutation, selection, grouping and distribution.

Probability
Introduction, various types of events; Classical definition of probability; Random and Discrete variables; Bayes' Theorem and question types.

Data Interpretation
Introduction; Different ways of representing data- Narration based, pictorial, pie chart, Bar graph, line charts; various questions based upon them.

UNIT 2: VERBAL APTITUDE

Cloze test
Intricacies of cloze test, correct use of specific adjectives, concept of sentence improvement, writing concept, auxiliaries and modals.

Words
Concept of consistency, precision, concision in terms of reading and writing, advance word choice with respect to placement papers, SAP (Subject-Audience-Purpose) approach.

Clauses
Subordinate Clauses- The noun clause, the adjective clause, the adverb clause, Analysis of simple and complex sentences, prepositional phrases, transformation of sentences.

Vocabulary
Revisiting vocabulary- high, medium and low frequency words, organization of ideas an thoughts in order to understand the text- The Pyramid Principle.

Questions
Various test taking skills in accordance with the placement papers.

UNIT 3: LOGICAL REASONING

Deductive Logic
Premises and conclusion structure, Quality of deductive argument, Syllogism, Conditional Arguments- If..then, only if..then, If and only if , Either or.

Puzzles
Grouping and selection, Binary logic- truth teller-lie teller, Team formation and miscellaneous puzzles.

Set Theory and Critical Reasoning
Union and Intersection of sets, Use of venn diagrams in problem solving with two, three, four set, concept of maxima-minima through Venn diagram.

Critical reasoning: Statement and Inferences, cause and Effects, Statement and Arguments- Strengthen or Weaken the argument, Statement Assertion and Reason.

Data Sufficiency

Data Sufficiency based on logical reasoning field like Coding-Decoding / Puzzle Test / Blood Relations / Mathematical calculations / clock / calendar / etc.

UNIT 4: SOFT SKILLS

Group Discussion

Importance, Do's & Don'ts, Personality Traits, Tips and Strategies, Types of Group Discussions.

Suggested Exercises, Games & Activities: Mock Group Discussions (on basic topics), with feedback sharing and error analysis.

Personal Interview

Importance, Do's & Don'ts, Personality Interview, Tips and Strategies, Etiquette Rules.

Suggested Exercises, Games & Activities: Mock Personal Interviews (contd.) with feedback sharing and error analysis.

Textbooks

1. Quantitative Aptitude**:** How to prepare for Quantitative Aptitude, Arun Sharma, McGraw Hill, 8th edition, 2018.
2. Logical Reasoning: A Modern Approach to Logical Reasoning-R.S. Aggarwal, S Chand Publishing; 2nd Colour edition-2018.
3. Verbal Aptitude: English is Easy- Chetanand Singh, BSC Publication-2018.
4. Soft Skills: Group Discussion on Current Topics by P. N. Joshi; Upkar Prakashan-2010.

Reference Book(s)

1. Quantitative Aptitude: Quantitative Aptitude for Competitive Examinations- R.S. Agarwal, S. Chand Publications-2017.
   Quantitative Aptitude: Quantitative Aptitude-Saurabh Rawat & Anushree Sah Rawat Savera Publishing House, 1st edition-2016.

2. Logical Reasoning: Logical Reasoning and Data Interpretation for the CAT - Nishit K Sinha, Pearson India; 5th edition-2016.
   Logical Reasoning: Wiley's Verbal Ability and Reasoning - P A ANAND, Wiley-2016.

3. Verbal Aptitude: Oxford Guide to English Grammar- John Eastwood, Oxford University Press-2003.
   Verbal Aptitude: Fun with grammar- Suzanne W. Woodward Pearson Education ESL-1996.

4. Soft Skills: A Complete Kit for Group Discussion by S. Hundiwala; Arihant publications; edition-2018.

Soft Skills: Basic Interviewing Skills by Raymond L. Gorden, Waveland Press, Inc.; 1 edition-1998.

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/Google drive.. Refer to your course on SAP for details.

Ability Enhancement (min 8 credits to be taken)

1. Department offering the course	Chemistry
2. Course Code	CHF201
3. Course Title	Environmental Science
4. Credits (L:T:P:C)	2:0:0:2
5. Contact Hours (L:T:P)	2:0:0
6. Prerequisites (if any)	None
7. Course Basket	Ability Enhancement Course

COURSE OBJECTIVE

To impart basic knowledge about the environment and its allied problems and to develop an attitude of concern for the environment. Further the course structure will create the awareness about environmental problems among students and motivate the students to participate in environment protection and environment improvement programs. The course aims to develop skills to help the concerned individuals in identifying and solving environmental problems.

COURSE OUTCOME:

1. At the end of the course, the student will be able to:
2. Demonstrate depleting nature of Environmental Resources and Ecosystem concepts.
3. Able to identify the structure and functioning of natural ecosystems.
4. Establish man-wildlife harmonious relationship.
5. Adapt to 3R (Reuse, Recovery, Recycle).Identify the causes and control measures related to Pollutions.
6. Illustrate and analyze various Case Studies related to Environmental issues and Env. Legislation.

CURRICULUM CONTENT

Unit 1: Basics of Environment and Natural Resources:

04 L

Definition and Concept of Environment, Multidisciplinary nature of environmental studies. Scope and importance of environmental studies, Need for public awareness, Environmental concerns and people. Introduction and classification of natural resources. Energy Resources, Water Resources, Land Resources, Forest Resources, Food Resources, Mineral Resources, Case studies related to over exploitation of resources and their impacts. Role of an individual in conservation of natural resources, Sustainable lifestyles.

Unit 2: Ecosystems:

04 L

Definition and concept of ecology, Structure and Function of an Ecosystem, Energy Flow in Ecosystems, Biogeochemical cycles (Nitrogen, Carbon, Phosphorus, Oxygen, Hydrological). Species interactions in ecosystems. Ecological succession and ecological

pyramids. Characteristic features of grassland, pond, desert and forest ecosystems. Ecosystem services and conservation.

Unit 3: Biodiversity and its conservation:

04 L

Introduction and types of biodiversity. Bio-geographic classification of India, Value and significance of biodiversity, Biodiversity at global, national and local levels, India: A mega-diversity nation, Biodiversity hotspots, Threats to Biodiversity: Poaching and man-wildlife conflicts, IUCN Red Data Book and endangered & endemic species of India. Biodiversity conservation strategies, Institutes and organizations.

Unit-4 Environmental Pollutions:

05 L

Introduction and Definition. Causes, consequences and control measures of: Air pollution, Water pollution, Noise pollution, Nuclear pollution, Soil pollution, Thermal and Marine pollution. Solid waste management, Bio-medical waste management. Disasters and its mitigation strategies, Global warming, Climate change, Acid rain, Ozone depletion and Smog. Pollution case studies. Role of an individual in pollution prevention.

Unit-5 Social Issues and Environment:

04 L

Sustainable Development: Concept and importance, Environmental Impact Assessment (EIA), GIS, Remote sensing. Water conservation and rain water harvesting. Resettlement and rehabilitation problems, Environmental audit, eco-labeling and eco-friendly business. Environmental Legislation in India, Population explosion and its impact on environment and human health, Value Education and environmental ethics.

Field work:

03 L

- Visit to a local area to document environmental asset: river/forest/grassland/hill/mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common flora and fauna.
- Study of a common ecosystem-pond, river, hill slopes, etc.

Text book [TB]:

1. BharuchaErach, 2004. Textbook for Environmental Studies, University Grants Commission, New Delhi.
2. Kaushik A & Kaushik C P. 2007. Perspectives in Environmental Studies, New Age International Publ.
3. S. Deswal & A. Deswal 2015. A Basic Course in Environmental Studies. Dhanpat Rai & Co.

REFERENCES

1. Miller T.G. Jr. 2002. Environmental Science, Wadsworth Publishing Co. (TB).
2. De A.K.,1996. Environmental Chemistry, Wiley Eastern Ltd.
3. Sharma, P.D. 2005. Ecology and environment, Rastogi Publication.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	**Humanities & Liberal Arts**
2. Course Code	**LAF285**
3. Course Title	**Indian Constitution**
4. Credits (L:T:P:C)	**2:0:0:2**
5. Contact Hours (L:T:P)	**2:0:0**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Ability Enhancement Course**

COURSE SUMMARY:

The Constitution of India is the supreme law of India. The document lays down the framework demarcating fundamental political code, structure, procedures, powers, and duties of government institutions and sets out fundamental rights, directive principles, and the duties of citizens. The course will provide knowledge of their constitutional rights to the students and also familiarize the students with the features of the Indian Constitution.

COURSE OBJECTIVE:

To familiarize the students with the features of the Indian Constitution

To provide a knowledge of their constitutional rights

COURSE OUTCOMES

On successful completion of the course, students will be able to achieve the following:

1. Enable the students to protect their rights
2. The students will be engaged in the political system of India

CURRICULUM CONTENT

Unit 1: Introduction

Constitution- meaning of the term, basic features Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive, Principles of State Policy, debates on Fundamental Rights and Directive

Unit 2: Union Government and its Administration

Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha Institutional Functioning: Prime Minister, Parliament and Judiciary, Power Structure in India: Caste, class and patriarchy

Unit 3: State Government and its Administration

Governor: Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions.

Unit-4 Local Administration

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected, Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit 5: Election Commission

Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women

TEXT BOOKS

1. Abbas, H., Kumar, R. & Alam, M. A. (2011) Indian Government and Politics. New Delhi: Pearson, 2011.
2. Chandhoke, N. & Priyadarshi, P. (eds.) (2009) Contemporary India: Economy, Society, Politics. New Delhi: Pearson.

REFERENCE BOOKS

1. Chakravarty, B. & Pandey, K. P. (2006) Indian Government and Politics. New Delhi: Sage.
2. Chandra, B., Mukherjee, A. & Mukherjee, M. (2010) India After Independence. New Delhi: Penguin.
3. Singh, M.P. & Saxena, R. (2008) Indian Politics: Contemporary Issues and Concerns. New Delhi: PHI Learning.
4. Vanaik, A. & Bhargava, R. (eds.) (2010) Understanding Contemporary India: Critical Perspectives. New Delhi: Orient Blackswan.

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

Course Structure & Syllabus of B.Sc (Hons) Physics
Applicable for Batch: 2021-24

1. Department offering the course	**Mechanical Engineering**
2. Course Code	**MEF209**
3. Course Title	**Entrepreneurship and Start-ups**
4. Credits (L: T:P:C)	**0:0:4:2**
5. Contact Hours (L: T: P)	**0:0:4**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Ability Enhancement Course**

Course Summary: The course provides foundational knowledge on various aspects of entrepreneurial venture creation and management during its life-cycle. It has been designed to address multidisciplinary audiences.

Course Objectives

The objective of the course is to teach key issues faced by entrepreneurs and managers at different stages of the life-cycle of an enterprise and is relevant both for aspiring entrepreneurs and for decision makers in established enterprises.

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

CO 1. Know basics of entrepreneurship and start up.
CO 2. Understand the economic aspects.
CO 3. Understand the government policies for start up.
CO 4. Understand the market and formulate a business plan for start up.

Curriculum Content

UNIT 1:

Conceptual definition of entrepreneurs, entrepreneurship and start up, historical development of entrepreneurship, entrepreneurship in economic theory, entrepreneurial practice, impact of Entrepreneurship on society, the role of entrepreneurship in economic development.

UNIT 2:

Entrepreneurial economy, entrepreneurship and economic development, type of Entrepreneurship, features and types of entrepreneurs, entrepreneur and small business, terms of entrepreneurship, sources of business ideas, technical and technological analysis of entrepreneurial projects, designing a business investment, angel Investor and Venture capitalist – Roles and Importance.

UNIT 3:

Forms of entrepreneurial organization, entrepreneurial process. Entrepreneurial and start-up strategies, role of Government agencies in Entrepreneurship development, entrepreneurial project: entrepreneurial venture and entrepreneurial development chain, knowledge of business economy.

UNIT 4:

Sources of capital, market research, understanding the market need for your concept, defining the business concept and formulating a business plan for start up, fundamentals of entrepreneurial management, business process: product design, operational art, stock management.

UNIT 5:

Entrepreneur biographies - the actual successes and failures, exit strategies for entrepreneurs, case studies of: successful entrepreneurial ventures, failed entrepreneurial ventures and turnaround ventures, some case studies related to product & technology.

Textbook(s)

1. Entrepreneurship- Theory, Process Practice –by Kuratko &Hodgetts, Thompson South-Western Publication.

Reference Books

1. Effective Entrepreneurial Management: Strategy, Planning, RiskManagement, and Organization - Robert D. Hisrich • VelandRamadani, Springer (2017).
2. Entrepreneurship –by Robert D. Hisrich (Edition-9).