# Approved Syllabus

# for

# Four Year Under Graduate Program (FYUGP)

# in

# Physics

## Under

# New Education Policy-2020

**Islamic University of Science and Technology**
**Awantipora, Pulwama -192122**

*Approved in Board of Studies (BoS) Meeting held on 04-03-2024*

**Outline of the Program**

Four-Year Undergraduate Program (FYUGP) in Physics at the Islamic University of Science and Technology, Awantipora in compliance with the New Education Policy 2020 reflects a commendable commitment to academic excellence and the advancement of knowledge. This program, carefully crafted to provide students with a robust foundation in theoretical and experimental physics, aligns with the university's dedication to expanding educational offerings and empowering the next generation of knowledge seekers.

The program's emphasis on interdisciplinary exploration is particularly noteworthy, as it encourages students to explore the connections between physics and other fields such as computer science, quantum computation/information, and material science. This interdisciplinary approach not only broadens students' perspectives but also equips them with the skills necessary to tackle complex real-world challenges that often require a multidisciplinary approach.

Furthermore, the inclusion of skill-based courses, in accordance with the objectives of the New Education Policy 2020, ensures the holistic development of students and enhances their employability in a variety of sectors. The program's curriculum, comprising of Major Courses (MJ), Interdisciplinary Minor Courses (MN), Multidisciplinary Courses (MD), Skill Enhancement Courses (SEC), and Ability Enhancement Courses (AEC), is designed to provide students with a comprehensive education that encompasses both theoretical knowledge and practical skills.

The commitment of the faculty members, described as young, dynamic, and research-oriented, is instrumental in guiding students through their academic journey and nurturing their scientific curiosity and critical thinking skills. The combination of classroom teaching, laboratory work, and hands-on research experiences ensures that students graduate with analytical thinking, mathematical proficiency, problem-solving capabilities, and a deep understanding of natural phenomena.

The program's emphasis on preparing students for diverse career paths, including research and development in industrial sectors, academia, data science, engineering, and finance, as well as advanced studies in physics or related disciplines, underscores its relevance and potential impact. Overall, the proposed FYUGP in Physics at the Islamic University of Science and Technology holds great promise in shaping the next generation of physicists and contributing to the advancement of knowledge and innovation.

**Pedagogy**: The pedagogy of teaching physics will focus on fostering critical thinking, active engagement of students, conceptual understanding, problem solving, and application of physics principles in real world context. The course will be taught using a combination of classroom teaching, hands on experiments, group discussions, problem solving activities, interactive demonstrations, and

research-oriented project work. Emphasis will be laid on the use of computer simulations, virtual laboratories, interactive multimedia, and online resources like Swayam, NPTEL etc to supplement classroom instructions. The teachers will adopt interdisciplinary approach by connecting physics principles to everyday experiences, engineering applications, technological advancement, and societal issues to demonstrate practicality and significance of subject. More importantly the pedagogy will focus on enthusing the students to follow the most recent advances in the field like quantum computation, bio-physics etc and choose research as a career option in these fields.

It is worthwhile mentioning that a robust system of advising of mentee by a mentor is in place in the department to help students overcome any problem/ shortcoming in studies or otherwise. Regular mentee-mentor meetings are held to notice the progress of the mentee. Appropriate counseling is given to students and they are treated with compassion and empathy whenever required.

**Assessment:** Regular assessment plays a crucial role in monitoring student progress and identifying areas that require additional support. As already indicated, students will be evaluated through a combination of written examinations, practical exercises, quizzes, presentations, and assignments. The assessments will be designed in a way that they measure the student's understanding of the subject matter and their ability to apply the concepts to practical situations. The aim of the course is to base the learning around the concept of Student-Centered Learning. Focus will be on the needs and interests of individual students, allowing them to learn at their own pace and in their own way. Teachers can personalize the learning experience by providing students with choices, opportunities for self-reflection, and feedback.

**Course Structure:**

The undergraduate program will be a four-year degree with multiple entry and exit points as per NEP 2020. The multiple entry and exit points are as given in the table below:

| S.No. | Course | Credits |
|---|---|---|
| 1. | Certificate | 40 Credits |
| 2. | UG Diploma | 80 Credits |
| 3. | 3-yearUG Degree | 120 Credits |
| 4. | 4-yearUG Hons | 160 Credits |
| 5. | 4-year UG with Research | 160 Credits |

**Multiple Entry Exit System (MEES):**

As the program offers multiple entry exit system (MEES), the below strategy explains it:

1. **1st Year:**
   a. **Entry:** Any student who has passed the higher secondary examination with Mathematics and Physics as core subjects with at least 55% marks will be eligible for the program.
   b. **Exit:** After successful completion of two semesters, a student can exit due to unforeseen circumstances and shall qualify for an undergraduate certificate. However, he/she needs to qualify an additional 4-credit vocational course/internship/Community Engagement.

2. **2nd Year:**
   a. **Entry:** All the students who have obtained undergraduate certificate after completing the first year (two semesters) of the undergraduate programme are eligible for the entry to the 2nd year of the programme.
   b. **Exit:** After completion of four semesters, a student can exit due to unforeseen circumstances and shall qualify for award of UG Diploma.

3. **3rd Year:**
   a. **Entry:** The entry requirement for 3rd year is a diploma obtained after completing two years (four semesters) of the undergraduate programme.
   b. **Exit:** After completion of six semesters, a student can exit and shall qualify for award of an UG Degree (3 Year) in Physics.

      If a student scores a CGPA of 7.5 or higher, he/she shall become eligible for UG Hons 4-year with Research.

4. **4th Year with Hons/Research:**
   a. **Entry:** An individual seeking admission to a Bachelor's degree (Hons/Research)in physics is required to have completed all requirements of the relevant three-year bachelor degree.

b. **Exit-I:**After completion of eight Semesters, a student shall qualify for award of UG Hons Degree (4 Year) in Physics.
**Exit-II:** After completion of eight Semesters with a 12 credit Research Project in Physics, the student shall qualify for the award of UG Hons Degree (4 Year) with Research in Physics.

**Course Code fixation for FYUGP:**
The following code system (5 characters) is adopted for FYUGP course in Physics.

ABC – Code of the Department which is offering the Course.

X – Specification of that Course

Y - Course Type

**Example: PHY – 100 - MJ**

## Types of Courses included in the proposed draft

Major Courses: MJ
Minor Courses: MN
Multi-Disciplinary Courses: MD
Ability Enhancement Course: AEC
Skill Enhancement Course: SEC
Value Added Course: VAC
Vocational Minor: VM

**Program structure prepared as per the New Education Policy (NEP), 2020.**

## SEMESTER I

| Course Type | Course Code | Course Title | Credit Distribution | | | | Marks Distribution | | | Total Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | P | T | Total | Int. | Ext. | Total | |
| Major | PHY-100-MJ | Mechanics | 2 | 1 | 1 | 04 | 30+ 20* | 50 | 100 | 20 |
| Minor | DOMS-100-MN | Mathematics – I | 3 | 0 | 1 | 04 | 30+ 20* | 50 | 100 | |
| Multidisciplinary | DOCH-100-MD | Chemistry – I | 2 | 0 | 1 | 03 | 15+ 10* | 25+ 25** | 75 | |
| Multidisciplinary | DOMS-101-MD | Statistics – I | 2 | 0 | 1 | 03 | 25+ 15* | 35 | 75 | |
| Ability Enhancement Course (AEC) | DOELL-100-AE | Technical Writing | 2 | 0 | 1 | 03 | 25+ 15* | 35 | 75 | |
| Skill Enhancement Course (SEC) | DOCS-100-SE | C Programming | 2 | 0 | 0 | 02 | 15 + 10* | 25 | 50 | |
| Value Added Course (VAC) | DOCS-101-VA | Digital and Technological Solutions | 2 | 0 | 0 | 02 | 15 + 10* | 25 | 50 | |
| Value Added Course (VAC) | CVS-100-VA | Health and Wellness | 2 | 0 | 0 | 02 | 15 + 10* | 25 | 50 | |

* Assignment/ Presentation

** External exam for Chemistry Lab.

**No. of Major Courses to be opted= 01 (04 Credits)**

**No. of Minor Courses to be opted= 01 (04 Credits)**

**No. of Multidisciplinary Courses to be opted = 01(03 Credits).**

**No. of Ability Enhancement Courses to be opted = 01(03 Credits).**

**No. of Skill Enhancement Courses to be opted = 01(02 Credits).**

**No. of Value-Added Courses to be opted = 02(02 credit each =04 Credits).**

**Total No. of credits = 20**

## SEMESTER II

| Course Type | Course Code | Course Title | Credit Distribution | | | | Marks Distribution | | | Total Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | P | T | Total | Int. | Ext. | Total | |
| Major | PHY-150-MJ | Electricity and Magnetism | 2 | 1 | 1 | 04 | 30+ 20* | 50 | 100 | 20 |
| Minor | DOMS-150-MJ | Mathematics – II | 3 | 0 | 1 | 04 | 30+ 20* | 50 | 100 | |
| Multidisciplinary | DOCH-150-MD | Chemistry – II | 2 | 0 | 1 | 03 | 15+ 10* | 25+ 25** | 75 | |
| Multidisciplinary | DOMS-151-MD | Statistics – II | 2 | 0 | 1 | 03 | 25+ 15* | 35 | 75 | |
| Ability Enhancement Course (AEC) | HKC-150-AE | Introduction to Kashmiri language and literature | 2 | 0 | 0 | 02 | 25+ 15* | 35 | 75 | |
| Skill Enhancement Course (SEC) | DOCSE-150-SE | Programming in Python | 1 | 1 | 0 | 02 | 15 + 10* | 25 | 50 | |
| Value Added Course (VAC) | CIR-150-VA | Understanding India | 2 | 0 | 0 | 02 | 15 + 10* | 25 | 50 | |
| Value Added Course (VAC) | DOMS-152-VA | Environmental Science | 2 | 0 | 0 | 02 | 15 + 10* | 25 | 50 | |

* Assignment/ Presentation

** External exam for Chemistry Lab.

**No. of Major Courses to be opted= 01 (04 Credits)**

**No. of Minor Courses to be opted= 01 (04 Credits)**

**No. of Multidisciplinary Courses to be opted = 01(03 Credits).**

**No. of Ability Enhancement Courses to be opted = 01(03 Credits).**

**No. of Skill Enhancement Courses to be opted = 01(02 Credits).**

**No. of Value-Added Courses to be opted = 02(02 credit each =04 Credits).**

**Total No. of credits = 20**

## SEMESTER III

| Course Type | Course Code | Course Title | Credit Distribution | | | | Marks Distribution | | | Total Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | P | T | Total | Int. | Ext. | Total | |
| Major | PHY-200-MJ | Waves and Oscillations | 3 | 0 | 1 | 04 | 30+ 20* | 50 | 100 | 20 |
| Major | PHY-201-MJ | Basic Electronics | 2 | 1 | 1 | 04 | 30+ 20* | 50 | 100 | |
| Minor | DOMS-200-MN | Mathematics – III | 3 | 0 | 1 | 04 | 30+ 20* | 50 | 100 | |
| Multidisciplinary | DOECE-200-MD | Optical Fiber Communication | 2 | 0 | 1 | 03 | 25+ 15* | 35 | 75 | |
| Multidisciplinary | DJMC-200-MD | Science Communication | 2 | 0 | 1 | 03 | 15+ 10* | 25+ 25** | 75 | |
| Ability Enhancement Course (AEC) | DOELL-200-AE | Communication Skills | 2 | 0 | 1 | 03 | 25+ 15* | 35 | 75 | |
| Skill Enhancement Course (SEC) | DOCS-200-SE | MatLab | 2 | 0 | 0 | 02 | 15 + 10* | 25 | 50 | |

* Assignment/ Presentation

** Practical Assignment/Group Project

**No. of Major Courses to be opted= 02 (08 Credits)**

**No. of Minor Courses to be opted= 01 (04 Credits)**

**No. of Multidisciplinary Courses to be opted = 01(03 Credits).**

**No. of Ability Enhancement Courses to be opted = 01(03 Credits).**

**No. of Skill Enhancement Courses to be opted = 01(02 Credits).**

**Total No. of credits = 20**

## SEMESTER IV

| Course Type | Course Code | Course Title | Credit Distribution | | | | Marks Distribution | | | Total Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | P | T | Total | Int. | Ext. | Total | |
| Major | PHY-250-MJ | Optics | 3 | 0 | 1 | 04 | 30+ 20* | 50 | 100 | 20 |
| Major | PHY-251-MJ | Digital Electronics and Logic Design | 3 | 0 | 1 | 04 | 30+ 20* | 50 | 100 | |
| Major | PHY-252-MJ | Thermal Physics | 3 | 0 | 1 | 04 | 30+ 20* | 50 | 100 | |
| Major | PHY-253-MJ | Lab IV | 0 | 4 | 0 | 04 | 30 + 20* | 50 | 100 | |
| Vocational Minor | DOCS-250-VM | Artificial Intelligence | 3 | 0 | 1 | 04 | 30 + 20* | 50 | 100 | |

* Assignment/ Presentation

**No. of Major Courses to be opted= 04 (16 Credits)**

**No. of Vocational Minor Courses to be opted= 01 (04 Credits)**

**Total No. of credits = 20**

## SEMESTER V

| Course Type | Course Code | Course Title | Credit Distribution | | | | Marks Distribution | | | Total Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | P | T | Total | Int. | Ext. | Total | |
| Major | PHY-300-MJ | Mathematical Physics - I | 3 | 0 | 1 | 04 | 30+ 20* | 50 | 100 | 20 |
| Major | PHY-301-MJ | Classical Mechanics | 3 | 0 | 1 | 04 | 30+ 20* | 50 | 100 | |
| Major | PHY-302-MJ | Quantum Mechanics I | 3 | 0 | 1 | 04 | 30+ 20* | 50 | 100 | |
| Major | PHY-303-MJ | Lab V | 0 | 2 | 0 | 02 | 15 + 10* | 25 | 50 | |
| Internship | PHY-304-IN | Internship | 0 | 2 | 0 | 02 | | 50 | 50 | |
| Vocational Minor | PHY-305-VM | Introduction to R Programming | 2 | 2 | 0 | 04 | 30 + 20* | 50 | 100 | |

* Assignment/ Presentation

**No. of Major Courses to be opted= 04 (14 Credits)**

**Internship =01 (02 credits)**

**No. of Vocational Minor Courses to be opted= 01 (04 Credits)**

**Total No. of credits = 20**

## SEMESTER VI

| Course Type | Course Code | Course Title | Credit Distribution | | | | Marks Distribution | | | Total Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | P | T | Total | Int. | Ext. | Total | |
| Major | PHY-350-MJ | Classical Electrodynamics | 3 | 0 | 1 | 04 | 30+ 20* | 50 | 100 | 20 |
| Major | PHY-351-MJ | Solid-State Physics | 3 | 0 | 1 | 04 | 30+ 20* | 50 | 100 | |
| Major | PHY-352-MJ | Atomic and Molecular Physics | 3 | 0 | 1 | 04 | 30+ 20* | 50 | 100 | |
| Major | PHY-353-MJ | Lab VI | 0 | 4 | 0 | 04 | 30 + 20* | 50 | 100 | |
| Vocational Minor | PHY-354-VM | Digital Image Processing | 3 | 0 | 1 | 04 | 30 + 20* | 50 | 100 | |

* Assignment/ Presentation

**No. of Major Courses to be opted= 04 (16 Credits)**

**No. of Vocational Minor Courses to be opted= 01 (04 Credits)**

**Total No. of credits = 20**

## SEMESTER VII

| Course Type | Course Code | Course Title | Credit Distribution | | | | Marks Distribution | | | Total Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | P | T | Total | Int. | Ext. | Total | |
| Major | PHY-400-MJ | Mathematical Physics - II | 3 | 0 | 1 | 04 | 30+ 20* | 50 | 100 | 20 |
| Major | PHY-401-MJ | Statistical Mechanics | 3 | 0 | 1 | 04 | 30+ 20* | 50 | 100 | |
| Major | PHY-402-MJ | Quantum Mechanics II | 3 | 0 | 1 | 04 | 30+ 20* | 50 | 100 | |
| Major | PHY-403-MJ | Lab VII | 0 | 4 | 0 | 04 | 30 + 20* | 50 | 100 | |
| Minor | PHY-404-MN | Astrophysics I | 2 | 0 | 0 | 02 | 15 + 10* | 25 | 50 | |
| Minor | PHY-405-MN | Experimental Techniques | 2 | 0 | 0 | 02 | 15 + 10* | 25 | 50 | |
| Minor | PHY-406-MN | Fourier Optics | 2 | 0 | 0 | 02 | 15 + 10* | 25 | 50 | |
| Minor | PHY-407-MN | Fundamentals of Nanomaterials and Nanotechnology | 2 | 0 | 0 | 02 | 15 + 10* | 25 | 50 | |

* Assignment/ Presentation

**No. of Major Courses to be opted= 04 (16 Credits)**

**No. of Minor Courses to be opted= 02 (02 credits each = 04 Credits)**

**Total No. of credits = 20**

## SEMESTER VIII

| Course Type | Course Code | Course Title | Credit Distribution | | | | Marks Distribution | | | Total Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | P | T | Total | Int. | Ext. | Total | |
| Major | PHY-450-MJ | Nuclear Physics | 3 | 0 | 1 | 04 | 30+ 20* | 50 | 100 | 20 |
| Major | PHY-451-MJ | Particle Physics | 3 | 0 | 1 | 04 | 30+ 20* | 50 | 100 | |
| Major | PHY-452-MJ | Electronic Devices and Circuits | 3 | 0 | 1 | 04 | 30+ 20* | 50 | 100 | |
| Major | PHY-453-MJ | Lab VIII | 0 | 4 | 0 | 04 | 30 + 20* | 50 | 100 | |
| Minor | PHY-454-MN | Astrophysics II | 2 | 0 | 0 | 02 | 15 + 10* | 25 | 50 | |
| Minor | PHY-455-MN | Superconductivity | 2 | 0 | 0 | 02 | 15 + 10* | 25 | 50 | |
| Minor | PHY-456-MN | Group Theory | 2 | 0 | 0 | 02 | 15 + 10* | 25 | 50 | |
| Minor | PHY-457-MN | Atmospheric Physics | 2 | 0 | 0 | 02 | 15 + 10* | 25 | 50 | |
| Skill Enhancement Course (SEC) | PHY-458-SE | Research Project | 0 | 0 | 0 | 12 | | | 300 | |

* Assignment/Presentation

**For 4 Year UG Hons**:

**No. of Major Courses to be opted= 04 (16 Credits)**

**No. of Minor Courses to be opted= 02 (02 credits each = 04 Credits)**

**Total No. of credits = 20**

**For 4 Year UG Hons with Research:**

**No. of Major Courses to be opted= 01 (04 Credits)**

**No. of Minor Courses to be opted= 02 (02 credits each = 04 Credits)**

**No. of Skill Enhancement Courses= 1(12 Credits.)**

**Total No. of credits = 20**

**Total credit and Marks distribution:**

| Course Type | Certificate Course | | UG Diploma | | UG 3-Year | | UG 4-Year Hons | | UG 4-Year Hons with Research | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Credits | Marks | Credits | Marks | Credits | Marks | Credits | Marks | Credits | Marks |
| Major | 08 | 200 | 32 | 800 | 62 | 1550 | 94 | 2350 | 82 | 2050 |
| Minor | 08 | 200 | 12 | 300 | 12 | 300 | 20 | 500 | 20 | 500 |
| Multidisciplinary | 06 | 150 | 09 | 225 | 09 | 225 | 09 | 225 | 09 | 225 |
| AEC | 06 | 150 | 09 | 225 | 09 | 225 | 09 | 225 | 09 | 225 |
| SEC | 04 | 100 | 06 | 150 | 06 | 150 | 06 | 150 | 18 | 450 |
| Value-Added Courses | 08 | 200 | 08 | 200 | 08 | 200 | 08 | 200 | 08 | 200 |
| Minor Vocational | 04* | 100 | 04 | 100 | 12 | 300 | 12 | 300 | 12 | 300 |
| Internship | | | | | 02 | 50 | 02 | 50 | 02 | 50 |
| TOTAL | 40 +4* | 1000 +100* | 80 | 2000 | 120 | 3000 | 160 | 4000 | 160 | 4000 |

***For the Award of certificate course, a student needs to qualify an additional 4-credit (100 Marks)**

# *Semester I*

Course Title: **Mechanics**
Course Code: **PHY-100-MJ**
Credits: **04**
Type of Course: **Major**

Contact Hours: 4 hours per week (Total: 40 lectures+ 08 tutorials + 16 Labs)

Internal assessment: 50% (30% Exam (1.5 Hour) and 20% assignments/attendance) End-Term Examination: (2. 5 Hours) 50%

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## Course Objectives

The course aims to provide students with a solid understanding of mechanics principles and skills that are valuable in various academic and professional contexts.

## Course Outcome

On completion of the course, student will be able to:

- Develop and grasp Understanding of foundational principles such as Newton's laws of motion and their extension to many particle systems, conservational laws and other concepts which form the backbone of classical mechanics.
- Gain skills in mathematical modeling and proficiency, problem analysis, and solution techniques by applying theoretical principles and using mathematical techniques such as calculus, differential equations, and vector algebra in solving problems involving motion, forces, and energy.
- Develop an intuitive understanding of how objects behave under different physical conditions, and predicting outcomes based on physical laws.
- Develop laboratory Skills by conducting experiments in laboratory to verify theoretical principles and gain practical experience in data collection and analysis.

**Course Title: Mechanics** **Credits: 4**
**Course Code: PHY-100-MJ** **L 2 T 1 P 1**

**Unit I**

Coordinate Systems: Cartesian, spherical polar coordinates and cylindrical coordinate systems. Length, Area and Volume elements in different coordinate systems, Components of velocity and acceleration in spherical polar and cylindrical coordinate systems, Jacobian Transformation.

Newton's Laws, Inertial and non-inertial frames of references, uniformly rotating frame.

**Unit II**

Work and Energy: Work - Energy Theorem. Conservative and non- conservative forces. Potential Energy. Energy diagram, Stable and unstable equilibrium. Force as gradient of potential energy. Work done by non-conservative forces.

Rigid Body motion, Rotational motion, Angular momentum of a particle and system of particles, moments of inertia and their products, Principal moments and axes, Theorems of parallel and perpendicular axes.

**Unit III**

Central Force fields: Motion of a particle under a central force field, Two-body problem and its reduction to one-body problem and its solution equation of orbits, Kepler's Laws and their derivation, Planetary motion, Gravitational law and Field; Potential and Field due to spherical shell, solid sphere and Disc.

**Unit IV**

Newtonian relativity; Galilean transformation, Michelson-Morley experiment, Postulates of Special Theory of Relativity. Constancy of speed of light, Lorentz Transformations. Simultaneity of events. Length contraction. Time dilation. Twin Paradox. Relativistic addition of velocities.

**Unit V Mechanics Lab**

**List of Experiments**

1. Measurement of length (or diameter) using vernier calipers, screw gauge and travelling microscope.
2. To determine the Moment of Inertia of a Flywheel.
3. To determine the Young's modulus of a rectangular bar by bending of beam method.
4. To determine the Modulus of Rigidity of a wire by Maxwell's needle.
5. To determine g by bar pendulum.
6. To determine g by Kater's pendulum
7. To study the motion of a spring and calculate spring constant and value of g

**Text Book:**

1. An Introduction to mechanics, D. Kleppner, R. J. Kolenkow, 2019,McGraw-Hill 978-0-07-06477877.

**Reference Books:**

2. University Physics, F. W Sears, M.W Zemansky, H. D Young , Addison Wesle,13th edition, ISBN: 978129202063.
3. Mechanics Berkeley Physics course, v.1: Charles Kittel, et. Al. 2007, Tata McGraw-Hill.

4. Feynman Lectures, Vol. I, R. P. Feynman, R. B. Leighton, M. Sands,2008, Pearson Education, ISBN 978-3319067896.
5. Mechanics, D.S. Mathur, S. Chand, ISBN: 8121905990.

Course Title: **Mathematics I**
Course Code: **DOMS-100-MN**
Credits: **04**
Type of Course: **Minor**

Contact Hours: 4 hours per week (Total: 52 lecture + 12 tutorials)

Internal assessment: 50% (30% Exam (1.5 Hour) and 20% assignments/attendance) End-Term Examination: (2. 5 Hours) 50%

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## Course objectives

- Establish the fundamental theorems and applications of the calculus of single variable functions.
- Explore the concepts, properties and aspects of the differential calculus of single variable functions,
- Optimization (min/max) problems and an introduction to integration.

## Course Outcomes

After successful completion of course the students will be able

- Grasp the concept of limits and continuity and be able to apply them to various functions.
- Master rules and techniques for finding derivatives of various functions, including polynomials, trigonometric functions, exponential functions, logarithmic functions, and composite functions.
- Understanding and application of the Fundamental Theorem of Calculus.

**Course Title: Mathematics I** **Credits: 4**
**Course Code: DOMS-100-MN** **L 3 T 1 P 0**

**Unit I**

Definition of a limit, calculating δ-ε, The tangent and velocity problems, limit of a function, limits using limit laws, continuity, limits at infinity, horizontal asymptote, derivatives and rates of change, derivative as a function.

**Unit II**

Derivatives of polynomial and exponential functions, product and quotient rule, derivatives of trigonometric functions, chain rule, implicit differentiation, derivatives of logarithmic functions, rates of change, exponential growth and decay, linear approximations and differentials

**Unit III**

Maximum and minimum values, the Mean Value Theorem, how derivatives affect the shape of a graph, indeterminate forms and L'Hospital's Rule, curve sketching, optimization problems

**Unit IV**

Anti derivatives, areas and distances, the definite integral, the Fundamental Theorem of Calculus, indefinite integral.

**Text Book**:

1. Calculus – Early Transcendentals by James Stewart

**Reference books:**

1. Calculus by Thomas and Finney. Morgan Kaufmann Pub.
2. A First Course in Calculus - by Serge Lang,
3. Calculus – by Howard Anton
4. Integral Calculus - by Hari Krishan
5. Calculus I & II by Tom Apostol

Course Title: **Chemistry I**
Course Code: **DOCH-100-MD**
Credits: **03**
Type of Course: **Multidisciplinary**

Contact Hours: 3 hours per week (Total: 40 lecture + 08 tutorials)

Internal assessment: 50% (30% Exam (1.5 Hour) and 20% assignments/attendance) End-Term Examination: (2. 5 Hours) 50%

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## Course objective

The objective of this course is to provide students with a comprehensive understanding of the fundamental principles and theories of chemistry concerning atomic structure and chemical.

## Course Outcomes

On successful completion of the course the students will

- Gain fundamental understanding of the atomic structure and the chemical bonding particularly hybridization and various theories of hybridization.
- Be able to apply molecular orbital theory and VSPER theory to study the formation of molecular orbitals of various molecules.
- Understand various equations of state and the origin and properties of various transport phenomenon of gaseous state.

**Course Title: Chemistry I** **Credits: 3**
**Course Code: DOCH-100-MD** **L 2 T 1 P 0**

**UNIT-I. Atomic Structure and Chemical Bonding-I**

Bohr's theory, Wave particle Duality, Uncertainty principle, Schrödinger equation, H-atom, Atomic orbitals, Electron spin. Pauli's principle. Many-electron atoms. Covalent and ionic bonding. Valance bond theory. VBT for hydrogen molecule. Hybridization and resonance. Molecular orbital theory..Directional characteristics of covalent bond and types of hybridizations. Conclusions and limitations of VB theory. Percent ionic character from dipole moment and electronegativity difference. Homonuclear and heteronuclear diatomics.

**UNIT-II. Chemical Bonding-II**

Molecular orbital theory.LCAO MO method (1e–2c and 2e–2c system). Symmetry and overlap in forming molecular orbitals in the LCAO method. Energy level diagrams. Bond order and its significance.Magnetic properties of homo & hetero nuclear diatomic molecules ($N_2$. $O_2$. $F_2$. HCl. CO & NO) Multicenter bonding in electron deficient molecules. VSEPR theory: assumptions. shapes of selected molecules ($BF_3$. $NH_3$. $H_2O$. $SF_4$. $ClF_3$ and $XeF_2$). Ionic Bonding: Lattice energy and Born-Haber cycle. Factors affecting the structure of ionic solids. Radius ratio effect.Fajan's rules and its applications.

**UNIT-III. States of Matter**

Gaseous State: Deviation of gases from ideal behavior. Van der Waals equation of state. Critical Phenomenon. PV isotherms of real gases. Continuity of states. Isotherms of van der Waals equation. Relationship between critical constants and van der Waals constants. Law of corresponding states. Reduced equation of state. Molecular velocities: Root mean square. average. most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities. Collision number. Mean free path. Collision diameter. Liquid State: Liquefaction of gases and adiabatic expansion. Intermolecular forces. Structure of liquids (a qualitative description).

**Text Books**


1. Basic Inorganic Chemistry; F.A. Cotton, G. Wilkinson and P.L. Gauss; 3rd ed.; 2002; Wiley.
2. The Elements of Physical Chemistry; P. Atkins, J.d. Paula and P.W. Atkins; 4th ed.; 2005; Oxford University Press.


**Reference Books**


1. Concise Inorganic Chemistry; J.D. Lee; 2008; 5th ed.; Oxford University Press.
2. Inorganic Chemistry; G.L. Miessler and D.A. Tarr; 3rd ed.; 2008; Pearson India.
3. Organic Chemistry (Vol. I &and II); I.L Finar; 6th ed.; 2002; Pearson Education India.
4. Principles of Physical Chemistry; by B.R. Puri, M.S. Pathania and L.R. Sharma; 47th edition; 2020. Vishal Publishing Co.
5. Physical Chemistry Through Problems; S.K Dogra and S. Dogra; 2015; New Age International Private Limited.
6. University General Chemistry An Introduction to Chemical Science; C.N. Rao; 2009; Macmillan India Limited.

Course Title: **Statistics I**
Course Code: **DOMS-101-MD**
Credits: **03**
Type of Course: **Optional (Multidisciplinary)**

Contact Hours: 3 hours per week (Total: 40 lecture + 08 Tutorials)

Internal assessment: 50% (30% Exam (1.5 Hour) and 20% assignments/attendance) End-Term Examination: (2. 5 Hours) 50%

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## Course objective

- The students will get overview of basic statistical concept and measurements.
- The students will be able to manage quantitative and quantitative data materials and also will be able to calculate the descriptive statistics from real data sets, its presentation and interpretation

## Course outcome

After successful completion of course the students will

- Understand the importance and basics of data, types and properties of data as well as the tabular, graphical and other representations of data
- Learn to calculate the measures of central tendency and apply and measures of dispersion.
- Understand the sample and various techniques of sampling.

**Course Title: Statistics I** **Credits: 3**

**Course Code: DOMS-101-MD** **L 2 T 1 P 0**

**Unit I**

Statistical Methods: Definition and scope of Statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurement- nominal, ordinal, interval and ratio. Presentation: tabular and graphical, including histogram and ogives, consistency and independence of data with special reference to attributes.

**Unit II**

Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments, absolute moments, factorial moments, skewness and kurtosis, Sheppard's corrections.

**Unit III**

Correlation Analysis - conceptual frame work .Methods of studying correlation-Scatter diagram, Karl Pearson's correlation coefficient, Spearman's rank correlation coefficient and concurrent deviation methods. Probable error (ungrouped data), coefficient of determination. Regression Analysis - definition and uses, Linear and Non-linear regression. Regression equations and regression coefficient, Properties of regression coefficient, multiple regression.

**Text Book:**


1. Goon A.M., Gupta M.K.Dasgupta B (2001):Fundamentals of Statistics (Vol.2), Word Press


**Reference Books:**


1. Murthy M.N. (1977): Sampling Theory & Statistical Methods, Statistical Pub. Society, Calcutta
2. Des Raj and Chandhok P.(1998): Sample Survey Theory, Narosa Publishing House.
3. Cochran W.G (1984):Sampling Techniques( 3rd Ed.), Wiley Eastern
4. Mukhopadhyay P.(1998): Theory and Methods of Survey Sampling, Prenctice Hall
5. Sampat S.(2001) Sampling Theory and Methods, Narosa Publishing House
6. Tarray T. A. (2016): Statistical Sample Survey Methods and Theory, Elite Publishers, Delhi.
7. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
8. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.

Course Title: **Technical Writing I**
Course Code: **DOELL-100-AE**
Credits: **03**
Type of Course: **Ability Enhancement Course (AEC)**

Contact Hours: 3 hours per week (Total: 40 lecture + 08 Tutorials)

Internal assessment: 50% (30% Exam (1.5 Hour) and 20% assignments/attendance) End-Term

Examination: (2. 5 Hours) 50%

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## Course objective

The course will provide an introduction to the idea of the technical writing and help to perceive the distinctness of technical writing from other forms of writing.

## Course outcome

After successful completion of the course

- The students will learn the writing skills the features and distinctiveness of technical writing selection of topic, thesis statement, developing the thesis introductory, developmental, transitional and concluding paragraphs.
- The students will be able to write formal and informal scientific and technical reports.

**Course Title: Technical Writing** **Credits: 3**
**Course Code: DOELL-100-AE** **L 2 T 1 P 0**

**Unit I**

Communication: Language and communication, differences between speech and writing, distinct features of writing. Writing Skills; Selection of topic, thesis statement, developing the thesis introductory, developmental, transitional and concluding paragraphs, linguistic unity, coherence and cohesion, descriptive, narrative, expository and argumentative writing.

**Unit II**

Technical Writing: Scientific and technical subjects; formal and informal writings; formal writings/reports, handbooks, manuals, letters, memorandum, notices, agenda, minutes; common errors to be avoided.

**Unit III**

Role of a Technical writer, Principles of Technical Writing, Documentation deliverables, Printed documentation and Online Help Systems, working with images and illustrations, Understanding Audience/Readers, Collecting and Organizing information, Drafting information verbally and visually, Producing Information.

**Text Book**

1. Alfred, Gerald, Charles T. Brusaw, and Walter E.Oliu. Handbook of Technical Writing. St. Martin's Press, 2003.

**Reference Books**

1. Byrne, D. Teaching Writing Skills. UK: Longman, 1988. Print
2. Rizvi, M Ashraf. Effective Technical Communication, The McGraw-Hill companies.
3. Prasad, P. The Functional Aspects of Communication Skills, Delhi.
4. Sen, Leena. Communication Skills, Prentice Hall of India, New Delhi.
5. Technical Communication: Principles and Practice, Second Edition by Meenakshi Raman and Sangeeta Sharma, Oxford Publications.

Course Title: C **Programming**
Course Code: **DOCS-100-SE**
Credits: **02**
Type of Course: **Skill Enhancement Course (SEC)**

Contact Hours: 2 hours per week (Total: 30 lectures)

Internal assessment: 50% (30% Exam (45 min) and 20% assignments/attendance) End-Term

Examination: (1.5 Hours) 50%

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## Course objective

The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs, applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future.

## Course outcomes

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

- Formulate simple algorithms for arithmetic and logical problems, translate the algorithms to programs (in C language),
- Test and execute the programs and correct syntax and logical errors,
- Develop efficient algorithms for solving a problem and implementation.
- Use the various constructs of a programming language viz. conditional, iteration and Recursion

**Course Title:** C **Programming** **Credits: 2**
**Course Code: DOCS-100-SE** **L 2 T 0 P 0**

**UNIT I**

C programming language: Evolution, Features & Importance. Basic Structure of C programs, Character Set, Identifiers, Reserved Words, Data Types, Constants, Variables, Symbolic Constants, Casting and Standard Libraries. Logical and Control Structures: Assignment, Arithmetic, Relational, Logical, Compound, Increment, Decrement, Bitwise Operators &Special Operators. IF, IF – ELSE, Nested IF – ELSE, ?: , SWITCH CASE. Looping Constructs: FOR, WHILE, DO-WHILE, EXIT, BREAK, CONTINUE. Arrays: Types of arrays, Initialization, dynamic arrays. Character Arrays & Strings. String-handling functions.

**UNIT II**

Functions: Concepts, Elements, Prototypes &Types. Passing Arrays to Functions. Storage classes, Recursion. Command-line arguments. Multifile programming. Preprocessing. Pointers: Concepts, Variables, swapping data, swapping address v/s data, pointers &arrays, Pointers to pointers, pointer to strings, pointer arithmetic, additional operators, pointers to functions, void pointers. Structures and Unions: Syntax & use, members, structures & pointers, array of structures, structures &functions, structure within structures.

**Text Book**

1. Programming in ANSI C 6th Edition “E. Balaguruswamy”
2. Robert Lafore, “Object Orientation with C++ Programming”, Waite Grou

**Reference Books**

1. Object Oriented Programming with C++ “ E. Balagurusamy”
2. Herbert Schildt, “C++ The Complete Reference”, Tata McGraw Hill
3. Dennis Richie & Kernighan, “C Programming Language”, Prentice Hall
4. Dietel & Dietel, “How to program”, Pearson Education

Course Title: **Digital and Technological Solutions**
Course Code: **DOCS-101-VA**
Credits: **02**
Type of Course: **Value Added Course (VAC)**

Contact Hours: 2 hours per week (Total: 30 lectures)

Internal assessment: 50% (30% Exam (45 min) and 20% assignments/attendance) End-Term Examination: (1. 5 Hours) 50%

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## Course objective

- To gain familiarity with digital paradigms
- To sensitize about role & significance of digital technology
- To provide know how of communications & networks
- To bring awareness about the e-governance and Digital lndia initiative
- To provide a flavour of emerging technologies - Cloud, Big Data, AI 3D printing

## **Course Outcome**:

After successful completion of the course the students

- Will gain knowledge about digital paradigm.
- Realize of importance of digital technology, digital financial tools, e-commerce.
- Know how of communication and networks.
- Familiarity with the e-governance and Digital India initiatives
- An understanding of use & applications of digital technology.
- Basic knowledge of AI, machine learning and big data

**Course Title: Digital and Technological Solutions** **Credits: 2**
**Course Code: DOCS-101-VA** **L 2 T 0 P 0**

**Unit I**

Introduction & Evolution of Digital Systems, Role & Significance of Digital Technology. information & Communication Technology & Tools, Computer System & it's working, Software and its types. Operating Systems: Types and Functions. Problem Solving: Algorithms and Flowcharts. Communication Systems: Principles, Model & Transmission Media. Computer Networks & internet: Concepts & Applicatiorls, WWW, Web Browsers, Search Engines, Messaging, Email, Social Networking. Computer Based lnformation System: Significance & Types. E-commerce & Digital Marketing: Basic Concepts, Benefits & Challenges.

**Unit II**

Digital lndia & e-Governance: initiatives, infrastructure, Services and Empowerment. Digital Financial Tools: Unified Payment interface, Aadhar Enabled Payment System, USSD, Credit/Debit Cards, e-Wallets, internet Banking, NEFT/RTGS and IMPS, Online Bill Payments and poS. Cyber Security: Threats, Significance, Challenges, Precautions, Safety Measures, & Tools.

Emerging Technologies & their applications: Overview of Cloud Computing, Big Data, internet of Things, Virtual Reality, Block chain, Robotics, Artificial intelligence, 3-D Printing. Future of Digital Technologies.

**Text Books**

1. Fundamentals of Computers by E Balagurusamy- Tata Mc GrawHill
2. Data Communications and Networking by Behrouz A. Forouzan - McGraw Hill

**Reference Books**

1. Cloud Computing- Principals and Paradigms by Buvya, Broberg, and Gosciniski- Wiley
   E commerce" by Laudon.
2. Artificial lntelligence- A Modern Approach by Russel and Norving" - Pearson Education.
3. lnternet of Things by Samuel Greengard - MIT press
4. lntroduction to Computers by Peter Norton - Tata McGraw Hill
5. E-Commerce Concepts, Models, Strategies- C.S.V. Murthy
6. Basics of Artificial lntelligence and Machine Learning by Dheeraj Mehrotra - Notion press.
7. Big Data for dummies by Hurwith, Nugent,Halper, Kaufman, Wiley & Sons - Wiley

Course Title: **Health and Wellness**
Course Code: **CVS-100-VA**
Credits: **02**
Type of Course: **Value Added Course (VAC)**

Contact Hours: 2 hours per week (Total: 30 lecture)

Internal assessment: 50% (30% Exam (45 min) and 20% assignments/attendance) End-Term Examination: (1. 5 Hours) 50%

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## Course objectives

- To help understand the importance of a healthy lifestyle
- To familiarize students about physical and mental health
- To create awareness of various life style related diseases
- To provide understanding of stress management

## Course outcomes

After successful completion of the course the Students will gain

- Comprehensive understanding of the physical, mental, emotional, and social dimensions of health and Students will wellness.
- Ability to assess personal health status and identify areas for improvement using tools such as health assessments, fitness tests, and self-reflection.
- Acquisition of stress management techniques, relaxation strategies, and coping skills to enhance resilience and promote mental and emotional well-being.

**Course Title: Health and Wellness** **Credits: 2**
**Course Code: CVS-100-VA** **L 2 T 0 P 0**

**Unit I: Introduction to Health & Wellness**

Define and differentiate health and wellness. importance of health and wellness Education. Local, demographic, societal issues and factors affecting health and wellness. Diet and nutrition for health & wellness. Essential components of balanced diet for healthy living with specific reference to the role of carbohydrates, proteins, fats, vitamins & minerals. Malnutrition, under nutrition and over nutrition. Processed foods and unhealthy eating habits. Body systems and common diseases. Sedentary lifestyle and its risk of disease. Stress, anxiety, and depression. Factors affecting mental health. identification of suicidal tendencies. Substance abuse (Drugs, Cigarette, Alcohol), de-addiction, counseling and rehabilitation

**Unit II: Management of Health and Wellness**

Healthy foods for prevention and progression of Cancer, Hypertension, Cardiovascular, and metabolic diseases (Obesity, Diabetes, Polycystic Ovarian Syndrome). Types of Physical Fitness and its Health benefits. Modern lifestyle and hypo-kinetic diseases; prevention and management through exercise. Postural deformities and corrective measures. Spirituality and mental health. Role of Yoga, asanas and meditation in maintaining health and wellness. Role of sleep in maintenance of physical and mental health.

**Text Books**


1. Physical Activity and Health by Claude Bouchard, Steven N. Blair, William L. Haskell
2. Mental Health Workbook by Emily Attached & Marzia Fernandez, 2021


**Reference Books**


1. Mental Health Workbook for Women: Exercises to Transform Negative Thoughts and lmprove Well-Being by Nashay Lorick,2022
2. Lifestyle Diseases: Lifestyle Disease Management, by C. Nyambichu & Jeff Lumiri, 201,9.
3. Physical Activity and Mental Health by Angela Clow & Sarah Edmunds, 2013

# *Semester II*

Course Title: **Electricity and Magnetism**
Course Code: **PHY-150-MJ**
Credits: **04**
Type of Course: **Major**
Contact Hours: 4 hours per week (Total: 40 lecture + 08 tutorials + 16 Labs.)
Internal assessment: 50% (30% Exam (1.5 Hour) and 20% assignments/attendance) End-Term Examination: (2.5 Hours) 50%

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## Course Objectives

The objective of the course is to provide students with a comprehensive understanding of the fundamental principles governing electricity and magnetism and its applications in engineering and daily use.

## Course Outcomes

Completion of this core course will enable the students to:

- Gain understanding of Fundamental Concepts electric charge, electric field, magnetic field, electromagnetic induction,
- Learn laws and rules governing electricity and magnetism such Coulomb’s, Gauss's law, and Ampere's law and their applications to calculation field intensities in various situations.
- Develop mastery of mathematical tools such as vector calculus, differential equations, and complex numbers in nr analyzing and solving problems in electricity and magnetism.
- Gain Laboratory Skills as course include a laboratory component where students conduct experiments to observe and measure electric and magnetic phenomena, verify theoretical principles, and develop skills in data collection and analysis.

**Course Title: Electricity and Magnetism** **Credits: 4**
**Course Code: PHY-150-MJ** **L 2 T 1 P 1**

**Unit I**

Electric field: Divergence and Curl of Electric Field, Electric flux, Gauss' Law with applications. Conservative nature of Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. The Uniqueness Theorem. Potential and Electric Field of a dipole. Force and Torque on a dipole. Electrostatic energy of system of charges. Electrostatic energy of a charged sphere. Method of Images, Conductors in an electrostatic Field. Surface charge and force on a conductor.

**Unit II**

Dielectric Properties of Matter: Electric Field in matter. Polarization, Bound Charges and their physical interpretation. Field inside a dielectric, Capacitor (parallel plate, spherical, cylindrical) filled with and without dielectric, Electric Displacement vector D and Gauss' Law in dielectrics, Conductance, Electrical Susceptibility, permittivity and Dielectric Constant in Linear dielectrics. Relations between E, P and D, Energy in Dielectric systems

**Unit III**

Magnetostatics: Magnetic Forces and Magnetic Fields, Magnetic force between current elements and definition of Magnetic Field B. Biot-Savart's Law and its simple applications: straight wire and circular loop. Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital Law and its application to (1) Solenoid and (2) Toroid. Curl and Divergence of B. Vector Potential. Magnetic Force on (1) point charge (2) current carrying wire (3) between current elements. Torque on a current loop in a uniform Magnetic Field.

**Unit IV**

Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferro-magnetic materials. Magnetization vector (M). Magnetic Intensity (H). Relation between B, H, M. Ferromagnetism. B-H curve and Hysteresis.

**Unit V Electricity and Magnetism Lab**

**List of Experiments**

1. Use of Multimeter for measuring (a) Resistances (b) AC and DC Voltages (c) DC current (d) capacitances (e) checking electrical fuses
2. To study the characteristics of a series RC circuit.
3. To determine an unknown low resistance using potentiometer.
4. To determine an unknown low resistance using Carey Foster's bridge
5. Measurement of field strength B and its variation in a solenoid (determine dB/dx)
6. To verify the Thevenin and Norton theorems
7. To verify the superposition and maximum power transfer theorems
8. To determine the self inductance of a coil by Anderson's Bridge
9. To determine unknown capacitance by De'Sauty's bridge.

**Text Book:**

1. Introduction to Electrodynamics, David J. Griffiths, Pearson.

**Reference Books:**


1. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education
2. Lectures on Physics, Vol II, Richerd Feynman, Pearson Pub.
3. Electricity & Magnetism, J.H. Fewkes &J.Yarwood. Vol. I, 1991, Oxford Univ. Press
4. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
5. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
6. Fundamentals of Electricity and Magnetism - B.D. Duggal & C.L. Chhabra, Vikas Publishing House Private Limited.
7. Practical Physics, C. L. Arora, S.Chand publishers.
8. A textbook of Practical Physics, Indu Prakash, Kitab Mahal pub.
9. Practical Physics, Anchal Srivastava and R. K. Shukla, New Age Pub.

Course Title: **Mathematics II**
Course Code: **DOMS-150-MN**
Credits: **04**
Type of Course: **Major**
Contact Hours: 4 hours per week (Total: 52 lecture + 12 tutorials)
Internal assessment: 50% (30% Exam (1.5 Hour) and 20% assignments/attendance) End-Term Examination: (2.5 Hours) 50%

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## Course Objectives

The aim of this course is to introduce basic fundamentals of vector calculus. It also introduces students to manipulate vectors to perform geometrical calculations in three dimensions.

## Course Outcomes

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

- Understand different coordinate systems, including Cartesian, polar, cylindrical, and spherical coordinates, and the ability to work with vector fields in these coordinate systems.
- Master vector operations such as dot product, cross product, and vector projection.
- Understand vector fields and their properties, including gradient fields, divergence, curl, and line integrals.
- Able to apply vector calculus concepts to solve problems in physics, engineering, and other fields, such as fluid flow, electromagnetism, and conservation laws.

**Course Title: Mathematics II** **Credits: 4**
**Course Code: DOMS-150-MN** **L 3 T 1 P 0**

**Unit I**

Vectors, Transformation of vectors under rotation, inversion and translation.
Vector functions and space curves, derivatives and integrals of vector functions, arc length and curvature, motion in space- velocity and acceleration.

**Unit II**

Vector fields, line integrals, fundamental theorem for line integrals, Green's theorem, curl and divergence, parametric surfaces and their areas, surface integrals, Volume Integrals, Stoke's theorem, Divergence theorem

**Unit III**

Introduction to systems of linear equations, Gauss-Jordan elimination, matrices and matrix operations, matrix arithmetic, transpose and adjoint of a matrix, inverses, diagonal, triangular and symmetric matrices, determinants, cofactor expansion, row reduction

**Unit IV**

vector spaces, subspaces, linear independence, basis and dimension, row space, column space, null space, rank and nullity. Inner products, orthogonality, orthonormal bases, Gram-Schmidt process, change of basis
Eigenvalues and eigenvectors, diagonalization, orthogonal diagonalization, general linear transformations.

**Text Book:**

1. Calculus – Early Transcendentals by James Stewart (2006 Edition)
2. Linear Algebra – Schaum's Outline Series

**Reference Books:**

3. A First Course in Calculus - by Serge Lang,
4. Calculus – by Howard Anton,
5. Textbook of Calculus - by Larson and Edwards,
6. Schaum's Outline of Vector Analysis,
7. Calculus I & II by Tom Apostol
8. Elementary Linear Algebra by Howard Anton and Chris Rorres
9. Linear Functions and Matrix Theory by Bill Jacob
10. A Textbook on Matrices by Hari Krishen
11. Linear Algebra and its Applications by David C. Lay, Springer
12. Linear Algebra and its Applications by Gilbert Strang Thomson Learning

Course Title: **Chemistry II**
Course Code: **DOCH-150-MD**
Credits: **03**
Type of Course: **Multidisciplinary**

Contact Hours: 3 hours per week (Total: 40 lecture + 08 Tutorials)

Internal assessment: 50% (30% Exam (1.5 Hour) and 20% assignments/attendance) End-Term Examination: (2. 5 Hours) 50%

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## Course objective

The objective of this course is

- To introduce students to the fundamental principles underlying various spectroscopic techniques.
- To explore the wide range of applications of spectroscopy across different scientific disciplines, including chemistry, physics, biology, environmental science, materials science, and more.

## Course Outcomes

After successful completion of the course the students will

- Understand the origin, characteristics and techniques and applications of rotational and vibrational spectroscopy
- Understand the principle, laws and applications of electronic spectroscopy.
- Understand the operation and applications of Scaniing electron microscopy and transmission electron microscopy

**Course Title: Chemistry II** **Credits: 3**
**Course Code: DOCH-150-MD** **L 2 T 1 P 0**

**Unit I: Rotational and vibrational Spectroscopy**

Introduction to spectroscopy, Interaction of light with mater, Peak position, Peak intensity and peak width. Principle of microwave spectroscopy, Classification of molecules, Rigid-rotor model, Effect of isotopic substitution on the transition frequencies, Intensities, non-rigid rotor, Stark effect and applications, Principle of IR, Modes of vibration in molecules, Zero point energy, Force constant and bond strength, Morse Potential energy diagram, Anharmonicity, Derivation of selection rules for diatomic molecules based on harmonic oscillator approximation, Vibrational-Rotational Spectroscopy, PQR Branches. Characteristic vibrational frequencies of various functional groups (group frequencies and fingerprint region), Effects of hydrogen bonding and solvent effect on vibrational frequencies, Overtones

**Unit II: Electronic Spectroscopy**

Principle of Electronic Spectroscopy UV-Vis spectroscopy, Beer-Lambert's Law and derivation, Additivity of absorbance, Factors causing deviations from Beer's law, Electronic spectroscopy of molecules: Energy levels, Vibrational course structure: progressions Intensity of Vibrational-Electronic spectra; Franck-Condon principle. Electronic excitations, involving $\pi$, $\sigma$ and n-electrons, Chromophores and auxochromes, shifts in UV spectroscopy (Electron donating, Electron withdrawing, Conjugation and extended conjugation), Instrumentation: Single and double-beam spectrophotometers.

**Unit III: Electron Microscopy**

Electron Microscopy: Scanning electron microscopy (SEM): basics, instrumentation, applications. Transmission electron microscopy (TEM): Introduction, Basic theory, Electron gun, Electromagnetic lenses, Imaging, Operating parameters- magnification, resolution, depth of field; Sample preparation, Specimen orientation and manipulation; Applications; Selected Area Electron Diffraction.

**Text Books**


1. Modern Spectroscopy, J. Michael, 4th Edn; Wiley 2013
2. Fundamentals of Molecular Spectroscopy, C.N. Banwell, E. M. Mccash, Tata McGraw Hill Pub, 4$^{th}$Edn. 1994.


**Reference Books**


1. NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry 3rd Edition, Kindle Edition.
2. Nature and Science, Transmission & Scanning Electron Microscopy, Ma, et al, 4(3), 2006
3. Principles of Instrumental Analysis, Skoog, Holler, Nieman,6$^{th}$Edn.;2006
4. Spectrometric Identification of Organic Compounds Robert M. Silverstein, JohnWiley,7$^{th}$Edn;2005.
5. Introduction to Instrumental analysis: R. D Braun (Tata McGraw-Hill),1987
6. Instrumental Methods of Chemical Analysis, G.W. Ewing, McGraw Hill Pub, 5$^{th}$Edn.;1985

Course Title: **Statistics II**
Course Code: **DOMS-151-MD**
Credits: **03**
Type of Course: **Multidisciplinary**

Contact Hours: 3 hours per week (Total: 40 lecture + 08 Tutorials)

Internal assessment: 50% (30% Exam (1.5 Hour) and 20% assignments/attendance) End-Term Examination: (2. 5 Hours) 50%

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## Course objective

The main objective of this course is to provide students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science like disease modeling, climate prediction and computer networks etc.

## Course outcomes

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

- Master basic probability concepts including probability distributions, random variables, and expected values.
- Learn estimation and hypothesis testing. Students should understand concepts such as confidence intervals and p-values.
- Familiarity with common probability distributions such as the normal distribution, binomial distribution, and Poisson distribution, including their properties and applications.
- Ability to analyze relationships between variables using correlation and regression analysis, including interpretation of correlation coefficients and regression coefficients.

**Course Title: Statistics II** **Credits: 3**

**Course Code: DOMS-151-MD** **L 2 T 1 P 0**

**Unit I**

Probability: Introduction, random experiments, sample space, events and algebra of events. Definitions of Probability – classical, statistical, and axiomatic. Statements and proof of addition theorem on probability, Conditional Probability, multiplication theorem on probability, Baye's theorem on conditional probability.

**Unit II**

Random variables: discrete and continuous random variables, p.m.f., p.d.f. and c.d.f., properties of random variables, Expected value of a random variable, Laws of expectation, moment generating function, characteristic function, univariate transformations with illustrations.

**Unit III**

Standard Distributions: Binomial, Poisson and Normal Distributions, Beta and Gamma Distribution, t - Distribution, F-Distribution, Chi-square Distribution and their applications.

**Text Book:**


1. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.


**Reference Books:**


1. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
2. Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford & IBH Publishing, New Delhi
3. Rohatgi V. K. and Saleh, A.K. Md. E. (2009): An Introduction to Probability and Statistics. 2ndEdn. (Reprint) John Wiley and Sons.
4. Mood A.M, Graybill F.A. and BoesD.C,: Introduction to the Theory of Statistics, McGraw Hill.
5. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
6. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
7. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.

Course Title: **Introduction to Kashmiri Language and Literature**
Course Code: **HKC-150-AE**
Credits: **02**
Type of Course: **Ability Enhancement Course (AEC)**

Contact Hours: 2 hours per week (Total: 30 lecutes)

Internal assessment: 50% (30% Exam (45 min) and 20% assignments/attendance) End-Term

Examination: (1. 5 Hours) 50%

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## Course objective

- To enable the students to understand their race, milieu and the moment and further to familiarize them with their language and cultural past.
- To develop an insight into the linguistic influences of other languages on Kashmir

## Course outcomes

After successful completion of the course the students will

- Develop appreciation for the cultural context of the Kashmiri language, including knowledge of traditional customs, practices, festivals, and folk traditions associated with the Kashmiri-speaking community
- Learn about the influence of other language like Sanskrit, Persian, urdu and English on kashmiri.
- Develop an appreciation for the richness and diversity of Kashmiri literature, including its various genres, authors, and historical developments.

**Course Title: Introduction to Kashmiri Language and Literature** **Credits: 2**
**Course Code: HKC-150-AE** **L 2 T 0 P 0**

**Unit I**

1. History and Culture of Kashmir: An Introduction. ۱۔ کشیر ہُند تمدُن تہٕ تاریخ : اکھ تعارُف
2. Early Inhabitants of Kashmir. ۲۔ کشیر ہنٛدی ابتدأیی بسکین
3. Origin of the Kashmiri Language. ۳۔ کأشر زبأنی ہُند آگُر
4. Dialects of the Kashmiri Language ۴۔ کأشرِ زبأنیٚ ہٕنٛز بولہ

**Unit-II**

1. Influence of Sanskrit on Kashmiri . ۱۔ کأشرس پیٹھ سنسکرتُک اثر
2. Influence of Persian on Kashmiri . ۲۔ کأشرس پیٹھ فارسیُک اثر
3. Influence of Urdu on Kashmiri. ۳۔ کأشرس پیٹھ اُردوہُک اثر
4. Influence of English on Kashmiri. ۴۔ کأشرس پیٹھ انگریزیُک اثر

**Unit-III**

1. General Introduction to Kashmiri Literature. ۱کأشرِ ادبُک اکھ عمومی تعارُف
2. Concept of Unity in Kashmiri Poetry. ۲۔ کأشرِ شأعری منٛز وحدتُک تصور
3. The Message of Lal Ded and Sheikh Ul Alam. ۳۔ لل دیٚد تہٕ شیخ العالم سُند پیغام
4. Kashmir in Kashmiri Poetry. ۴۔ کأشرِ شأعری منٛز کشی

**امدأدیکتابہٕ**

آزاد عبد الاحد کشمیری زبان اور شاعری
رہبر اوتار کرشن کأشرِ ادبچ تأریخ
منور ناجی تہٕ شوق شفیع کأشرِ ادبُک تواریخ
ساقی موتی لال گاشِریٚ
ملک نذیر احمد کشمیری سرمایہ الفاظ کے سر چشمے
ٹینگ محمد یوسف تلاش

**Recommended Books:**


1. Grierson G.A. Linguistic Survey of India Vol. 8 Part 2.
2. Sufi GMD Kasheer
3. Bamzai PNK History of Kashmir
4. Mohi-u-Din Akhter Antiquity of Kashmiri Language
5. Koul M.K. A Socio-Linguistic Study of Kashmiri.
6. Kachru Brij B. An introduction to Spoken Kashmiri.
7. Hajni Mohi-u-Din Hajni) Outlines of the Culture of Kashmiri (Discounts of Mohi-u-Din

Course Title: **Programming in Python**
Course Code: **DOCSE-150-SE**
Credits: **02**
Type of Course: **Skill Enhancement Course (SEC)**

Contact Hours: 2 hours per week (Total: 15 lectures + 15 Labs)

Internal assessment: 50% (30% Exam (45 min) and 20% assignments/attendance) End-Term Examination: (1. 5 Hours) 50%

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## Course objective

- The course aims at equipping students with essential concepts of Python programming and enable them to use python programming for solving data science problems.
- To understand the advantage of using Python libraries for implementing Machine Learning models

## Course outcomes

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

- Design and program Python applications
- Use lists, tuples, and dictionaries in Python programs.
- Use indexing and slicing to access data in Python programs
- Write loops and decision statements in Python
- Build and package Python modules for reusability.
- Design object-oriented programs with Python classes.

**Course Title: Programming in Python** **Credits: 2**
**Course Code: DOCSE-150-SE** **L 1 T 0 P 1**

**UNIT I**
Introduction to Python and Data types Installation and Working with Python, Understanding Python variables, Python basic Operators, Understanding python blocks. Declaring and using Numeric data types: int, float, complex, using string data type and string operations, defining list and list slicing, Use of Tuple data type.

**UNIT II**
Python Flow Control Conditional blocks using if, else and elif, Simple for loops in python, For loop using ranges, string, list and dictionaries, use of while loops in python, Loop manipulation using pass, continue, break and else, Programming using Python conditional and loops block.

**UNIT III**
Python Functions, Modules and Packages Organizing python codes using functions, importing own module as well as external modules, Understanding Packages, Powerful Lambda function in python, Programming using functions, modules and external packages

**UNIT VI**
Python string, list, dictionary manipulation and file operations Building blocks of python programs, understanding string in build methods, List manipulation using in build methods, Dictionary manipulation, Programming using string, list and dictionary in build functions, python file operations.

**UNIT V**
Python Object Oriented Programming Concept of class, object and instances, Inheritance, overlapping and overloading operators, Programming using Oops support. Introduction to libraries viz. numpy, pyplot and pandas.

**Text Books**


1. Mark Pilgrim, — "Dive into Python 3", Apress, 2009.
2. Allen Downey, Jeffrey Elkner, Chris Meyers, — "How to Think Like a Computer Scientist _ Learning with Python", Green Tea Press,2002.


**Reference Books**


1. John V. Guttag, — "Introduction to Computation and Programming using Python", Prentice Hall of India, 2014.
2. Mark Lutz, — "Learning Python: Powerful Object-Oriented Programming", Fifth Edition, O'Reilly, Shroff Publishers and Distributors, 2013.

Course Title: **Understanding India**
Course Code: **CIR-150-VA**
Credits: **02**
Type of Course: **Value Added Course (VAC)**

Contact Hours: 2 hours per week (Total: 30 lecures)

Internal assessment: 50% (30% Exam (45 min) and 20% assignments/attendance) End-Term Examination: (1. 5 Hours) 50%

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## Course objective

To expose the students to our social, economic and cultural heritage.

## Course Outcomes

On successful completion of this course the students will be able to have knowledge regarding

- Contemporary India with its historical perspective
- Constitutional obligation: Fundamental Rights and Duties
- Indian Knowledge System
- India’s struggle for freedom

**Course Title: Understanding India** **Credits: 2**
**Course Code: CIR-150-VA** **L 2 T 0 P 0**

**Unit I: Background of India's Culture, Education and Literature**
I. Harappan Civilization and Vedic Culture
II. Buddhism, Jainism, Sanatan (Hinduism) and Islam
III. Bhart's Natyashastra, Kalidas, Panani and Patanjali
IV. Taxila, Nalanda, Vishwa Bharati, BHU, AMU, IIT, IISC, AIIMS

**Unit II: Leaders of Indian Freedom Struggle and Ideas**
I. Mahatma Gandhi, J L Nehru, Subhash Chandra Bose
II. Freedom fighters from Jharkhand (Tilka Manjhi, Sidho-Kanho, Birsa Munda and Jatra Bhagat)
III. Non-Violence Satyagraha and Social Justice
IV. Acharya Vinoba Bhave

**Unit III: Indian Constitution**
I. Preamble
II. Salient Features
III. Fundamental Rights
IV. Fundamental Duties

**Unit IV: People, Economy and Geographical Features of India**
I. Physical Features: Mountains, Plateaus, Plan, Coast, Island, Vegetation, Rivers, Soil and Climate
II. Population, Racial Diversity, Growth and Distribution, Migration
III. Indian Economy: Agriculture, Industry and Trade and Transport
IV. India and its neighbors

Course Title: **Environmental Science**
Course Code: **DOMS-152-VA**
Credits: **02**
Type of Course: **Value Added Course (VAC)**

Contact Hours: 2 hours per week (Total: 30 lectures)

Internal assessment: 50% (30% Exam (45 min) and 20% assignments/attendance) End-Term

Examination: (1. 5 Hours) 50%

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## Course objective

This course attempts to create pro-environment attitude and a behavioural pattern in student community and society that attaches importance and priority to create sustainable life style and awareness on various environmental issues.

## Course outcomes

- This course is expected to inculcate a critical thinking on various dimensions of environment through knowledge, skill, critical thinking and problem-solving.
- The course will inculcate the importance and causes and consequences of depletion and conservation of natural resources
- The students will be able to understand the nature, meaning and importance of climate change.

**Course Title: Environmental Science** **Credits: 2**
**Course Code: DOMS-152-VA** **L 2 T 0 P 0**

**Unit 1: Understanding the Environment**

Environment: concept, importance and components, Ecosystem: Concept, structure and function (food chain, food web, ecological pyramids and energy flow), Ecosystem services: (Provisioning, regulating and cultural), Biodiversity: levels, values and threats and conservation, Concept and objectives of environmental education, environmental ethics

**Unit 2: Natural resources and Environmental pollution**

Natural resources: Renewable and non-renewable (Global status, distribution and production), Management of natural resources: Individual, community and government managed, Air, water and soil pollution: Causes, consequences and control, Solid waste management: Collection, segregation, transportation and disposal; 3R's, Climate change: Causes and consequences

**Text Book**:

1. Asthana, D. K. Text Book of Environmental Studies. S. Chand Publishing

**Reference Books:**

1. Basu, M., Xavier, S. Fundamentals of Environmental Studies, Cambridge University Press, India. 3. Basu, R. N., (Ed.) Environment. University of Calcutta, Kolkata.
2. Bharucha, E. Textbook of Environmental Studies for Undergraduate Courses. Universities Press. 5. Miller T.O. Jr., Environmental Science, Wadsworth Publishing Co.
3. Wagner K.D. Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p.
4. Mckinncv, M.L. & Schoch. R.M. Environmental Science systems & Solutions. Web enhanced edition. 639p.

# *Semester III*

Course Title: **Waves and Oscillations**
Course Code: **PHY-200-MJ**
Credits: **04**
Type of Course: **Core (Major)**
Contact Hours: 4 hours per week (Total: 52 lecture + 12 tutorials)
Internal assessment: 50% (30% Exam (1.5 Hour) and 20% assignments/attendance) End-Term Examination: (2.5 Hours) 50%

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## Course Objectives

The objective of this course is to provide students knowledge of behavior of various wave phenomena and oscillatory motion in different physical systems and their application in various fields of engineering and day to day life.

## Course Outcomes

Completion of this core course will enable the students to:

- Gain understanding of wave motion, its types and development and solution of the equation of motion under different set of conditions.
- Learn about the oscillatory motion, its characteristics and features, equation of motion and its solution and superposition of waves and oscillations
- Develop and model undamped, damped and forced oscillators

**Course Title: Waves and Oscillations** **Credits: 4**
**Course Code: PHY-200-MJ** **L 3 T 1 P 0**

**Unit I**

Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane Progressive (Travelling) Waves. Wave Equation. Particle and Wave Velocities. Differential Equation. Intensity of Wave. Water Waves: Ripple and Gravity Waves. Velocity of Transverse Vibrations of Stretched Strings. Velocity of Longitudinal Waves in a Fluid in a Pipe. Newton's Formula for Velocity of Sound. Laplace's Correction

**Unit II**

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. Electromagnetic nature of light. Definition and properties of wave front. Huygens Principle. Temporal and Spatial Coherence, Raman Scattering (Qualitative idea)

**Unit III**

Oscillations: Simple harmonic motion, Differential equation of SHM and its solution, energy of a simple harmonic oscillator, Examples of SHM: compound pendulum, torsional pendulum, bifilar oscillations, LC circuit, oscillations of two masses connected by a spring. Lissajous figures, combination of two mutually perpendicular simple harmonic vibrations of same frequency and different frequencies

**Unit IV**

Damped oscillations: Differential equation of damped harmonic oscillator and its solution, Logarithmic decrement, Energy of damped oscillator, Power dissipation, Quality factor, Relaxation time, Forced oscillations: Transient and steady state behavior, Resonance

**Text Book**

1. Vibrations and Waves, A. P. French, CBS publishers.

**References Books**

1. An Introduction to Mechanics by Daniel Kleppner, Robert J. Kolenkow.
2. The Physics of Waves and Oscillations By N.K. Bajaj.
3. Waves and Oscillations. S. Badami, V. Balasubramanian and K. Ram Reddy Orient Longman.
4. Mechanics of Particles, Waves and Oscillations. Anwar Kamal, New Age International.
5. Waves and Oscillations. N. Subramaniyam and Brijlal Vikas Publishing House Private Limited.
6. Vibrations and Waves by George C. King.

Course Title: **Basic Electronics**
Course Code: **PHY-201-MJ**
Credits: **04**
Type of Course: **Core (Major)**
Contact Hours: 4 hours per week (Total: 40 lecture + 08 tutorials +16 Labs)
Internal assessment: 50% (30% Exam (1.5 Hour) and 20% assignments/attendance) End-Term Examination: (2.5 Hours) 50%

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## Course Objectives

The aim of the course is to equip students with the knowledge, skills, and practical experience necessary to design, analyze, and troubleshoot analog electronic circuits in various applications.

## Course Outcome

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

- Develop comprehensive understanding of the principles, devices, and circuits used in analog electronic systems.
- Learn the basic electronic devices, their fabrication, characteristics and potential application like diode. Zener diode, photo diode, tunnel diode, solar cells.
- Develop understanding of the transistor and transistor amplifiers including their ideal characteristics, practical limitations, and applications in various circuit configurations and analysis using two-port model.
- The laboratory component where students design, build, test, and troubleshoot analog electronic circuits, gaining hands-on experience with electronic instrumentation and measurement techniques.

**Course Title: Basic Electronics** **Credits: 4**
**Course Code: PHY-201-MJ** **L 2 T 1 P 1**

**UnitI**

Band theory of solids, Classification of materials, Occupational probability, Fermi level, Semiconducting Materials and properties, Conductivity in semiconductors, Direct and indirect band gap semiconductors, Variation of charge carrier concentrations and Fermi level with Doping and temperature in intrinsic semiconductors and extrinsic semiconductors.

**Unit II**

PN junction diode, diode equation, diode built in voltage, junction capacitance, Various types of PN junction diodes and their usage (LEDs, Photodetectors, Solar cells, Zener etc.)Semiconductor lasers, Fabrication of band gap, Tunnel Diode.

**Unit III**

Fundamentals of operation of UJT and BJT, Configurations and modes of operation for BJT, dc biasing load line and operating point, Stability of operating point against thermal and Beta variations, stabilization factor, Biasing technique to BJT, fixed bias, emitter feedback bias, voltage divider bias, small signal BJT amplifiers, ac and dc equivalent circuits, hybrid model and hybrid parameters, approximate analysis of CE amplifier using h-parameters.

**Unit IV Electronics lab**

**List of Experiments**

1. To study V-I characteristics of PN junction diode, and Light Emitting diode.
2. To study the V-I characteristics of a Zener diode and its use as voltage regulator.
3. Study of V-I and power curves of solar cells, and find maximum power point and efficiency.
4. To study the characteristics of a Bipolar Junction Transistor in CE configuration.
5. To study the various biasing configurations of BJT for normal class A operation.
6. To study and design experiments using XPS module.

**Text Books:**


1. Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
2. Electronic devices and circuit theory, R. L. Boylestad and L. Nashelsky, Prentice Hall


**Reference Books:**


3. Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
4. Solid State Electronic Devices, B.G.Streetman&S.K.Banerjee, 6th Edn.,2009, PHI Learning
5. Electronic Devices & circuits, S.Salivahanan&N.S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill
6. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall
7. Electronic circuits: Handbook of design & applications, U.Tietze, C.Schenk,2008, Springer
8. Semiconductor Devices: Physics and Technology, S.M. Sze, 2nd Ed., 2002, Wiley India
9. Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India

Course Title: **Mathematics III**
Course Code: **DOMS-200-MN**
Credits: **04**
Type of Course: **Optional (Minor)**
Contact Hours: 4 hours per week (Total: 52 lecture + 12 tutorials)
Internal assessment: 50% (30% Exam (1.5 Hour) and 20% assignments/attendance) End-Term Examination: (2.5 Hours) 50%

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## Course Objectives

The primary objective of the course is to introduce students the concrete concept of differential equations and their applications in mathematical modeling oscillation theory etc.

## Course Outcome

After the successful completion of the course the students will

- Develop the skills to develop and solve the differential equation for physical systems.
- Learn the fundamentals of homogenous and non-homogeneous differential equations and the techniques to solve these differential equations.
- Learn the Laplace transforms and skills to use Laplace transform to solve the differential equations.

**Course Title: Mathematics III** **Credits: 4**
**Course Code: DOMS-201-MN** **L 3 T 1 P 0**

**Unit I**

Some basic differential equations; classification of differential equations; first order differential equations; linear equations and method of integrating factors; separable equations; modeling with first order equations; exact equations; numerical approximation and Euler's method

**Unit II**

Second order differential equations, homogeneous and non-homogeneous equations; fundamental solutions; linear independence and Wronskian; complex roots of the characteristics equation; higher order equations

**Unit III**

Series solutions of differential equations, Bessel and Legendre equations; series solutions near an ordinary point; regular singular points, Euler equations

**Unit IV**

Laplace transform; Laplace transforms of common functions, inverse transform and transforms of derivatives; Dirac-Delta function

**Text Book**:

1. Elementary Differential Equations and Boundary Value Problems by William E.□ Boyce and Richard C. Di Prima

**Reference Books:**

1. Differential Equations with Application and Historical Notes by G Simmons
2. Differential Equations by Dennis Zill
3. Differential Equations – Schaum Series
4. Introduction to Differential Equations by E.G. Phillips
5. Differential Equations by Jane Cronin

Course Title: **Optical Fiber Communication**
Course Code: **DOECE-200-MD**
Credits: **03**
Type of Course: **Multidisplinary**
Contact Hours: 3 hours per week (Total: 40 lecture + 08 Tutorials)
Internal assessment: 50% (30% Exam (1.5 Hour) and 20% assignments/attendance) End-Term Examination: (2.5 Hours) 50%

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## Course Objectives

The objective of this course is to provide students with a comprehensive understanding of the principles, technologies, and applications of optical fiber communication systems.

## Course Outcome

After successful completion of the course the students will

- Understand optical fiber, its structure, advantages and basic principle of optical fiber communication.
- Transmission characteristics of fibers under different physical and operating parameters.
- Understand the basic structure and operation of optical sources and detectors.
- Knowledge of various fiber fabrication techniques and optical fiber connectors.

**Course Title: Optical Fiber Communication** **Credits: 3**
**Course Code: DOECE-201-MD** **L 2 T 1 P 0**

**Unit I**

Introduction Block diagram of optical fiber communication system, Advantages of optical fiber communication, Optical fiber waveguides: structure, light propagation using ray theory, wave theory; modes in cylindrical guide, single mode fibers, cut-off wavelength, mode field diameter, effective refractive index,

**Unit II**

Transmission: Transmission characteristics of optical fiber, attenuation in optical fibers, intrinsic and extrinsic absorption, fiber bend losses, dispersion and pulse broadening, intramodal and intermodal dispersion for step and graded index fibers modal birefringence and polarization maintaining fibers.

**Unit III**

Optical Sources: Einstein relations and population inversion, feedback and threshold conditions, direct and indirect bandgap semiconductors, spontaneous and stimulated emission in p-n junction, heterojunctions, injection laser structure and its characteristics, LED: Introduction, power and efficiency, structures and characteristics.

**Unit IV**

Optical Detectors: Introduction, device types, detection principles; absorption, quantum efficiency, photodiodes and phototransistors, noise in p-n, p-i-n and photodiodes Introduction), APD receivers,

**Text Book**

1. Optical Fiber Communication Systems by J. M Senior

**Reference Books:**

1. Optical Communication Systems by John Gowar.
2. Optical Fiber Communication by G. E. Keiser
3. Optoelectronics by Wilson and Hawkes

Course Title: **Science Communication**
Course Code: **DJMC-200-MD**
Credits: **03**
Type of Course: **Multidisplinary**
Contact Hours: 4 hours per week (Total: 40 lecture + 08 tutorials)
Internal assessment: 50% (30% Exam (1.5 Hour) and 20% assignments/attendance) End-Term Examination: (2.5 Hours) 50%

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## Course Objectives

The objective of the course is to enable students to learn and apply effective communication techniques of scientific writing and the skills of scientific journalism.

## Course Outcome

On successful completion of the course the students will

- Understand the importance and role of science journalism in society.
- Gain the skills of effective scientific writing
- Skill to cover scientific news, conduct interviews
- Know about the challenges in science communication and ways to overcome these.

**Course Title: Science Communication** **Credits: 3**
**Course Code: DJMC-200-MD** **L 2 T 1 P 0**

## Unit I: Science Communication: Answering Basic questions

- What is Science Communication/Science Journalism?
- The Role of Science Journalism in the Society
- What is Science News?
- 3Es of Sci-Comm
- Audiences of Sciences Communication
- What Does It Mean to Write About Science for the Public?

## Unit II Talking and Writing Science

- Writing About Science Using Special Techniques (Painting a picture, tellinga Tale); Preparing and asking questions
- How do we turn science into the news?
- Drafting audience-specific messages
- Upside-Down structure of Sci-Comm

## Unit III Science Writing for Society & Media

- What makes science resonate with policymakers and politicians
- How the media covers science?
- Skills a science journalist needs to possess.
- Challenges in Science Communication & how to overcome them.
- Bridging Gap between Science & Society.

## Practical/Assignments:

The assignments/presentations and projects will be an essential component for the evaluation of this course:

- Speaking of Science: Oral Presentations – One per student.
- Every student will be required to make a 10–15 minutes oral presentation on any topics related to the course after consultation with the course instructor.
- Using written form as a tool for science outreach – Articles for community media o rmainstream media.
- Interviewing science professionals – Practical Assignment (Interviewing Scientists ontheir work and presenting their interviews in writing and/or in audio-visual form)
- Decoding Science through audio-visual medium or Mini-Magazine – Group project

## Text Books:


1. A Field Guide for Science Writers, Second Edition (2005, paperback) Editors: Deborah Blum, Mary Knudson, Robin Marantz Henig
2. Bauer, M.W. and Bucchi, M. eds., 2008. Journalism, science and society: Science communication between news and public relations. Routledge.


**Reference Books:**

3. Dijck, J. V. (2006). 'Picturizing science: The science documentary as multimedia spectacle'. International Journal of Cultural Studies, Vol.9, 5-24.
4. Gregory, J. and Miller, S., 2000. Science in public. Basic Books.
5. Meyer, G. (2016). In science communication, why does the idea of a public deficit always return? Public Understanding of Science, 25(4), pp.433-446.
6. Nielsen, K.H. (2013). Scientific communication and the nature of science. Science & Education, 22(9), pp.2067-2086.
7. Silverstone, R. (1984). Narrative strategies in television science—a case study. Media, Culture & Society, 6(4), 377-410.

Course Title: **Communication Skills**
Course Code: **DOELL-200-AE**
Credits: **03**
Type of Course: **Ability Enhancement Course**
Contact Hours: 4 hours per week (Total: 40 lecture + 08 tutorials)
Internal assessment: 50% (30% Exam (1.5 Hour) and 20% assignments/attendance) End-Term Examination: (2.5 Hours) 50%

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## Course Objectives

The objective of this course is to impart and enhance the skills of effective communication and personality development.

## Course Outcome

On successful completion of the course the students will

- Understand the essentials of communication, its significance & role of communication,
- Learn the methods of communication, verbal & non-verbal communication, and body language.
- Achieve the skills of structuring, styling and drafting reports.
- Achieve the skills of public speaking, fear management, elocution, extempore speeches, Group discussions, multi-perspective debates,
- Achieve the skills of writing and presenting papers, and resumes for various purposes,

**Course Title: Communication Skills** **Credits: 3**
**Course Code: DOELL-200-AE** **L 2 T 1 P 0**

**Unit-I**

Essentials of communication, its significance & Role The process of communication, Barriers to communication. Methods of communication, verbal & non-verbal communication, Interpersonal communication, decoding body language.

**Unit-II**

Written communication: Introduction to phonetic sounds, enriching vocabulary, using vocabulary in different contexts, essentials of strong writing skills, language and style. , Paragraph writing, developing perspective. Technical written communication: Nature, origin and development of technical written communication, salient features, difference between technical writing and general writing.

**Unit-III**

Technical written communication: Report writing, importance, structure, style and drafting of reports. Speaking: Public speaking, fear management, elocution, extempore speeches, Group discussions, multi-perspective debates, how to write and present papers, resume writing.

**Text Books:**


1. Seely, John. Writing and Speaking Delhi: OUP
2. Wallace, Michael J. Study Skills in English. New Delhi: CUP, 1998.


**Reference Books:**


3. Mohan, Krishna and Meera Banerji. Developing Communication Skill, Delhi: Macmillian, 1990.
4. Sasikumar V., P. Kiranmai Dutt and Geetha Rajeevan. A Course in Listening and Speaking (I & II) Bangalore: Foundation Books, 2006.
5. Sood, S C et al. Developing Language Skills, Delhi: Manohar, 1998.
6. Day, Richard R, ed. New Ways in Teaching Reading. Illinois: TESO 1993.
7. Chaturvedi, P.D and Mukesh Chaturvedi. Business Communication, Delhi: Pearson Education, 2006.
8. Trimble, Louis. English for Science and Technology, Cambridge: CUP, 1985.
9. Prasad, LM. OrganisationalBehaviour New Delhi: Sultan Chand & Sons, 1984.
10. Taylor, Shirley. Communication for Business New Delhi: Pearson Education, 1988

Course Title: **Introduction to MatLab**
Course Code: **DOCSE-200-SE**
Credits: **02**
Type of Course: **Skill Enhancement Course**
Contact Hours: 4 hours per week (Total: 30 lecture)
Internal assessment: 50% (30% Exam (45 min) and 20% assignments/attendance) End-Term Examination: (1. 5 Hours) 50%

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## Course Objectives

The objective of this course is to enable students to learn and use MatLab effectively to analyse and visualize data, solve problems and create plots.

## Course Outcome

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

- Use MATLAB effectively to analyse and visualize data with a clear understanding of the applications of the platform for engineers
- Demonstrate understanding and use of fundamental data types, data structures, functions and matrix operations
- Apply numeric techniques and computer simulations to solve engineering – related problems
- Design and document computer programs and analysis in a careful and complete manner so as to effectively communicate results, to facilitate evaluation and debugging by another programmer, and to anticipate and resolve errors
- Create and control simple plots and user – interface graphics objects in MATLAB

**Course Title: Introduction to MatLab** **Credits: 2**
**Course Code: DOCS-200-SE** **L 2 T 0 P 0**

**UNIT I**
Introduction to MATLAB and why it is widely used in engineering and science, advantages and limitations of the student edition of MATLAB, Start the MATLAB program and solve simple problems in the command window, Identify and use the various MATLAB windows, Define and use simple matrices, Name and use variables, difference between scalar, array, and matrix calculation[s, Express numbers in either floating-point or scientific notation, Adjust the format used to display numbers in the command window, Save the value of variables used in a MATLAB session, Save a series of commands.

**UNIT II**
Built in functions, elementary math functions (common math functions, rounding functions, discrete mathematics functions, trigonometric functions), data analysis functions (maximum and minimum, mean and median, sums and products), sorting functions, random numbers, complex numbers, Recognize and be able to use the special values and functions built into MATLAB.

**UNIT III**
Creating Function M-Files, Creating Your Own Toolbox of Functions, Anonymous Functions and Function Handles, Functions, Sub-functions. user defined input, output options, graphical input, Relational and logical operators, Find function, if/else, switch/case structure, for loops, while loops, midpoint break loops

**UNIT IV**
Manipulate matrices, extract data from matrices, solve problems with two matrix variables of different sizes, special matrices, Matrix Operations and Functions, Solutions of Systems of Linear Equations

**UNIT V**
Two-Dimensional Plots, Subplots, Other Types of Two-Dimensional Plots, Three Dimensional Plotting, Editing Plots from the Menu Bar, Creating Plots from the Workspace Window, Saving Your Plots,

**List of Experiments**
1. Practicing MATLAB environment with simple exercises to familiarize Command Window, History, Workspace, Current Directory, Figure window, Edit window, Shortcuts, Help files.
2. Data types, Constants and Variables, Character constants, operators, Assignment statements.
3. Control Structures: For loops, While, If control structures, Switch, Break, Continue statements.
4. Input-Output functions, Reading and Storing Data.
5. Vectors and Matrices, commands to operate on vectors and matrices, matrix manipulations.
6. Arithmetic operations on Matrices, Relational operations on Matrices, Logical operations on Matrices.

**Text Book**

1. Holly Moore, “MATLAB for Engineers”, Pearson
2. Bansal R.K, Goel A.K., Sharma M.K., “MATLAB and its Applications in Engineering”, Pearson Education, 2012.


**References**

1. Amos Gilat, “MATLAB-An Introduction with Applications”, Wiley India, 2009.
2. Stephen.J.Chapman, “Programming in MATLAB for Engineers”, Cengage Learning, 2011.

# *Semester IV*

Course Title: **Optics**
Course Code: **PHY-250-MJ**
Credits: **04**
Type of Course: **Core (Major)**
Contact Hours: 4 hours per week (Total: 52 lecture + 12 tutorials)
Internal assessment: 50% (30% Exam (1.5 Hour) and 20% assignments/attendance) End-Term Examination: (2.5 Hours) 50%

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## Course Objectives

The objective of the course is to provide students the foundation in optics preparing them for further study or careers in fields such as photonics, telecommunications, and biomedical imaging.

## Course Outcome

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

- Develop understanding of the major phenomenon associated with light particularly interference, diffraction and polarization.
- Learn the basics of optical fiber technology and its application in fiber optic communication.
- Explore practical applications of optics in various fields such as telecommunications, imaging, spectroscopy, laser technology, and quantum computing.

**Course Title: Optics** **Credits: 4**
**Course Code: PHY-250-MJ** **L 3 T 1 P 0**

**Unit I**

**Interference:** Division of amplitude and wavefront. Young's double slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: 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. 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**.**

**Unit II**

**Diffraction**: Fraunhofer diffraction: Single slit; Double Slit. Multiple slits & Diffraction grating. Fresnel Diffraction: Half-period zones. Zone plate. Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis. Polarization: Transverse nature of light waves. Plane polarized light – production and analysis. Circular and elliptical polarization

**Unit III**

**Polarization**: Methods of Polarization, Polarization by reflection, refraction, Double refraction, selective absorption, scattering of light – Brewster's law – Malus law – Nicol prism polarizer and analyzer – Refraction of plane wave incident on negative and positive crystals (Huygen‟s explanation) – Quarter wave plate, Half wave plate – Babinet's compensator – Optical activity, analysis of light by Laurent‟s half shade polarimeter.

**Unit IV:**

**Fiber Optics:** Total Internal Reflection, Introduction to Optical fibers, Types of optical fibers – Step and graded index fibers – Rays and modes in an optical fiber – Fiber material – Principles of optical fiber communication and advantages of optical fiber communication

**Text Book**

1. Optics by Ajoy Ghatak. The McGraw-Hill companies.

**Reference Books:**


1. Optics by Subramaniyam and Brijlal. S. Chand & Co.
2. Fundamentals of Physics. Halliday/Resnick/Walker.C. Wiley India Edition 2007.
3. Optics and Spectroscopy. R. Murugeshan and Kiruthiga Siva Prasath. S. Chand & Co.
4. Second Year Physics – Telugu Academy.
5. Modern Engineering Physics by A.S. Vasudeva. S.Chand& Co. Publications.
6. Feyman's Lectures on Physics Vol. 1,2,3 & 4. Narosa Publications.
7. Fundamentals of Optics by Jenkins A. Francis and White E. Harvey, McGraw Hill Inc.
8. D.P. Khandelwal, Optical and Atomic Physics‟ (Himalaya Publishing House, Bombay,1988)
9. Jenkins and White: „Fundamental of Optics‟ (McGraw-Hill)

Course Title: **Digital Electronics and Logic Design**
Course Code: **PHY-251-MJ**
Credits: **04**
Type of Course: **Core (Major)**
Contact Hours: 4 hours per week (Total: 52 lecture + 12 tutorials)
Internal assessment: 50% (30% Exam (1.5 Hour) and 20% assignments/attendance) End-Term Examination: (2.5 Hours) 50%

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## Course Objectives

The objective of the course is to introduce fundamental principles, design methodologies and practical applications of digital electronic and logic circuits.

## Course Outcome

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

- Understand principles of Boolean algebra and its applications in simplifying logic expressions and designing digital circuits.
- Learn various techniques for designing digital logic circuits, including combinational and sequential logic and implementation of combinational logic circuits for tasks such as arithmetic operations, multiplexers, demultiplexers, encoders, and decoders.
- Explore the principles of sequential logic design, including flip-flops, registers, counters, and state machines, and their applications in digital systems.
- Understand concept of programmable logic devices and Gain hands-on experience in programming Field-Programmable Gate Arrays (FPGAs) and Complex Programmable Logic Devices (CPLDs) for implementing digital circuits.

**Course Title: Digital Electronics and Logic Design** **Credits: 4**
**Course Code: PHY-251-MJ** **L 3 T 1 P 0**

**Unit I**

Number System & Boolean Algebra: Binary Number system, Conversion of bases, Complements, Weighted and Non-weighted codes, Binary Arithmetic,Boolean Laws and Logic Gates. Boolean functions- Canonical and Standard forms, Simplification of Boolean Functions, Idea of Minterms and Maxterms. Conversion of a Truth table into Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map.

Gate Implementations, Hazards and Glitches, Hazard detection and Hazard free implementations.

**Unit II**

Combinational Logic Design: Design procedure, Adders and Subtractors, Encoders and Decoders, Multiplexers/De-multiplexers and their use in combinational logic design, Digital Comparators, Timing response in Combinational networks.

**Unit III**

Sequential Logic Design: Latches and Flip-flops, Finite State Machines and Controllers, FSM based design- Counters, Sequence detectors, Signal generators, Moore and Mealy machines, Timing in state machines, Registers

**Unit IV**

Programmable Logic devices**:** Programmable Logic Array (**PLA),** Programmable Array Logic (**PAL),** Complex Programmable Logic Devices (**CPLDs),** Field Programmable Gate Arrays (**FPGAs).**

**Text Book:**

1. Digital Principles and Applications by Donald P. Leach, Albert Paul Malvino and Goutam Saha, McGraw Hill

**Reference Books:**

1. Digital Logic and Computer Design by M. Morris Mano, Pearson
2. Modern Digital Electronics by R.P. Jain, McGraw Hill
3. Digital Design by Frank Vahid, Wiley
4. Contemporary Logic Design by Randy H. Katz and Gaetano Borriello, PHI

Course Title: **Thermal Physics**
Course Code: **PHY-252-MJ**
Credits: **04**
Type of Course: **Core (Major)**
Contact Hours: 4 hours per week (Total: 52 lecture + 12 tutorials)
Internal assessment: 50% (30% Exam (1.5 Hour) and 20% assignments/attendance) End-Term Examination: (2. 5 Hours) 50%

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## Course Objectives

The course aims to provide students with a solid understanding of theoretical principles and practical applications of Thermal Physics course, including temperature, heat, laws of thermodynamics and kinetic theory.

## Course Outcome

On completion of the course, student will be able to:

- Understand the properties and behavior of thermodynamic systems, thermodynamic state and state function.
- Explore the first, second, and third laws of thermodynamics, and their implications for energy transfer, entropy, and thermodynamic processes such as isothermal, adiabatic, isobaric, and isochoric processes, and analyze their behavior using thermodynamic principles.
- Analyze the thermodynamic cycles of heat engines and refrigerators, including the Carnot cycle, and understand their efficiency and limitations
- Explore the kinetic theory of gases and its application in describing the macroscopic properties of gases, including pressure, temperature, and the ideal gas law.

**Course Title: Thermal Physics** **Credits: 4**
**Course Code: PHY-252-MJ** **L 3 T 1 P 0**

**Unit I**

Thermodynamic Description of state and state functions: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes.

Applications of First Law: General Relation between CP and CV, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Coefficient, Reversible and irreversible processes,

**Unit II**

Second law and Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.

Thermodynamical Potentials: Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations and applications - Joule-Thompson Effct, Clausius-Clapeyron Equation, Expression for (CP – CV ),CP /CV , TdS equations

**Unit III**

Kinetic Theory of Gases: Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic 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.

**Unit IV**

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. Joule- Thomson Effect for Real and Van der Waal Gases. Temperature of Inversion

**Text Books:**

1. Fundamentals of Statistical and Thermal Physics, F. Reif, Waveland Press Inc.

**Reference Books:**

1. Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
2. A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
3. Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears and G.L. Salinger. 1988, Narosa
4. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole

Course Title: **LAB IV**
Course Code: **PHY-253-MJ**
Credits: **04**
Type of Course: **Core (Major)**
Contact Hours: 4 hours per week (Total: 64 labs)
Internal assessment: 50% (30% Exam (1.5 Hour) and 20% assignments/attendance) End-Term Examination: (2. 5 Hours) 50%

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## Course Objective

The main objective of the course is to train students to realize the various physics concepts learnt in the class room in the laboratory and understand the various aspects of scientific measurement which include error analysis, data fitting and data interpretation.

## Course Outcomes

- To gain practical knowledge by applying the experimental methods to correlate with the physics theory.
- To learn the usage of electrical and optical systems for various measurements
- Apply the analytical techniques and graphical analysis to the experimental data.
- To develop intellectual communication skills and discuss the basic principles of scientific concepts in a group.

**Course Title: Lab IV** **Credits: 4**
**Course Code: PHY-253-MJ** **L 0 T 0 P 4**

**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 Temperature Coefficient of Resistance by Platinum Resistance Thermometer(PRT)
4. Measurement of Thermal Conductivity of a bad conductor by Lee disc method.
5. To determine efficiency of electric kettle.
6. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
7. To study the variation of thermo-emf across two junctions of a thermocouple with temperature.
8. To record and analyze the cooling temperature of an hot object as a function of time using a thermocouple and suitable data acquisition system
9. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge.
10. To determine the refractive index of glass prism by spectrometer.
11. To determine the wavelength of sodium light by plane diffraction grating.
12. To determine the wave length of prominent lines of mercury by plane diffraction grating.
13. To determine the wavelength of sodium light by Newton's rings.
14. To determine the wavelength of laser light by Fresnel Biprism.
15. To determine the wavelength of laser light by diffraction grating.

Course Title: **Artificial Intelligence**
Course Code: **DOCS-250-MJ**
Credits: **04**
Type of Course: **Core (Major)**
Contact Hours: 4 hours per week (Total: 52 lecture + 12 tutorials)
Internal assessment: 50% (30% Exam (1.5 Hour) and 20% assignments/attendance) End-Term Examination: (2. 5 Hours) 50%

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## Course Objective

- To present an overview of artificial intelligence (AI) principles and approaches.
- To develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic, and learning.
- To have understating of different search problems and their solution using various algorithms.
- To have basic understanding of machine learning strategies and their role in Artificial Neural Networks

## Course Outcomes

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

- Design intelligent machines/systems which act rationally and take the right decision at the right time.
- Define an AI problem and find a solution for it.
- Represent Knowledge using various knowledge representation schemes.
- Understand the basic knowledge acquisition methods.
- Understand Artificial Neural Networks and its applications

**Course Title: Artificial Intelligence** **Credits: 4**
**Course Code: DOCS-250-MJ** **L 3 T 1 P 0**

**UNIT I**

Introduction to Artificial Intelligence, Applications of Artificial Intelligence, and Intelligent agents: Agents and Environments, the nature of environments, structure of agents, Concept of Rationality. Introduction to First order logic, rules in FOL, Prepositional Logic.

**UNIT II**

Searching for solutions, uniformed search strategies. Search with partial information (Heuristic search) Greedy best first search, A* search, Memory bounded heuristic search, Heuristic functions.
Local search Algorithms: Hill climbing, local beam search.
Game Playing: Adversial search, Games, minimax, algorithm, optimal decisions in multiplayer games, Alpha-Beta pruning

**UNIT III**

Artificial Neural networks: Introduction to Artificial neural networks, analogy with biological neural network, McCullough-Pitts Model of a neuron, Single layer and Multilayer perceptron, sigmoid function, Training by back propagation, generalization, avoiding, over fitting. Introduction to Learning, concept of supervised, unsupervised and reinforcement learning.

**UNIT IV**

Knowledge Representation & Reasoning: Propositional logic, Theory of first order logic, Inference in first order logic, Resolution, Unification, Forward & Backward chaining, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM), Bayesian Networks

**Text Book**

1. Stuart Russel, Peter Norvig, Artificial Intelligence – A Modern Approach. Second Edition, PHI/Pearson Education.

**References:**

1. Rajendra Akerkar, Introduction to Artificial Intelligence –PHI.
2. Patrick Henry Winston., Artificial Intelligence, 3rd Edition, Pearson Edition
3. Patterson, Artificial Intelligence and Expert Systems PHI
4. Giarrantana/ Riley, Thomson Expert Systems: Principles and Programming- Fourth Edn,