

**GOVERNMENT OF RAJASTHAN**  
**BOARD OF TECHNICAL EDUCATION RAJASTHAN, JODHPUR**  
**TEACHING AND EXAMINATION SCHEME**  
**FOR DIPLOMA I SEMESTER (COMMON FOR ALL ENGINEERING BRANCHES)**  
**SEMESTER SCHEME, SESSION 2020-2021 & ONWARDS**

Subject Category	Subject Code.	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks	Credits
			Hours per week				End Semester Exam				Internal Assessment				
			L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU	PR(S)		
BS	1001	Mathematics-I	3	2	0	5	60	3	--	--	20	20	--	100	5
BS	1002	Applied Physics-I	3	2	0	5	60	3	--	--	20	20	--	100	5
BS	1003	Applied Chemistry	3	2	0	5	60	3	--	--	20	20	--	100	5
HS	1004	Communication Skills in English	3	0	0	3	60	3	--	--	40	--	--	100	3
ES	1005	Engineering Graphics	0	0	4	4	--	--	40	3	--	--	60	100	2
ES	1006	Engineering Workshop Practice	0	0	4	4	--	--	40	3	--	--	60	100	2
BS	1007	Applied Physics-I Lab	0	0	2	2	--	--	40	3	--	--	60	100	1
BS	1008	Applied Chemistry Lab	0	0	2	2	--	--	40	3	--	--	60	100	1
HS	1009	Communication Skills in English-Lab	0	0	2	2	--	--	40	3	--	--	60	100	1
HS	1010	Sports & Yoga	0	0	2	2	--	--	--	--	--	--	100	100	1
<b>VS</b>	1011	<b>Anandam (Joy of Giving)</b>	--	--	<b>1</b>	<b>1</b>	--	--	--	--	--	--	<b>100</b>	<b>100</b>	<b>2</b>
		<b>Students Centered Activities*</b>	--	--	<b>1</b>	<b>1</b>	--	--	--	--	--	--	--	--	--
		<b>Total</b>	<b>12</b>	<b>6</b>	<b>18</b>	<b>36</b>	<b>240</b>	--	<b>200</b>		<b>100</b>	<b>60</b>	<b>400</b>	<b>1100</b>	<b>28</b>
<b>Grand Total :</b>													<b>1100</b>	<b>28</b>	

- |  |   |
|--|---|
| 1. L : Lecture                                 | 5. PR : Marks for End Semester Exam for Practical             |
| 2. T : Tutorial                                | 6. CT : Marks for class tests (Internal Assessment)           |
| 3. P : Practical                               | 7. TU : Marks for tutorials (Internal Assessment)             |
| 4. TH : Marks for End Semester Exam for Theory | 8. PR(S) : Marks for practical and viva (Internal Assessment) |

**BS: Basic Science, HS: Humanities Science, ES: Engineering Science VS: Value Studies**

**Two weeks Induction Programme** for students to be offered right at the start of First Semester.

**Induction Programme includes** 1. Creative Arts 2. Universal Human Values 3. Literary 4. Proficiency Modules 5. Lectures by Eminent Persons 6. Visits to City / Nearby Industries 7. Familiarization to Department / Branch / Exhibition room.

**Anandam (Joy of Giving):** In addition to the practical of one hour every week, students will have to do activities at home and college after college hours.

**\* Student Centered Activities include** 1. Expert lectures/ practice sessions on technical topics of common interest 2. Personality development 3. Human values 4. Industrial visits 5. Art of living 6. Environmental issues 7. Quiz programs 8. Interview techniques 9. Greening and cleaning of campus etc.

Student Centered Activities will be graded as A, B, C & D on the basis of attendance and interest of the student in learning.

**MATHEMATICS-I**

Course Code	1001
Course Title	Mathematics-I
Number of Credits	5 (L-3,T-2,P-0)
Prerequisites	None
Course Category	Basic Science

**COURSE OBJECTIVES**

This course is designed to give a comprehensive coverage at an introductory level to the subject of Trigonometry, Differential Calculus, Complex Numbers and Basic elements of Algebra.

**COURSE OUTCOMES**

By the end of the course,

1. The students are expected to acquire necessary background in Trigonometry to appreciate the importance of the geometric study as well as for the calculation and the mathematical analysis.
2. The students are expected to learn the ability to find the effects of changing conditions on a system.
3. The students are expected to learn that Complex numbers enter studies of physical phenomena in ways that most people cannot imagine.
4. The students are expected to learn that the partial fraction decomposition lies in the fact that it provides an algorithm for computing the anti-derivative of a rational function.
5. The students are expected to learn the basic concept of Differential Calculus and will be able to apply them in Engineering problems.

**COURSE CONTENTS****1. TRIGONOMETRY**

- 1.1 Concept of angles, measurement of angles in degrees, grades and radian and their conversions.
- 1.2 T-Ratios of Allied angles (without proof), Sum, difference formulae (without proof).
- 1.3 Applications of Sum and difference formulae
- 1.4 Product formulae (Transformation of product to sum, difference and vice versa).
- 1.5 T- Ratios of multiple angles (2A, 3A).
- 1.6 Graphs of  $\sin x$ ,  $\cos x$  and  $\tan x$ .

**2. DIFFERENTIAL CALCULUS**

- 2.1 Definition of function; Graphs of  $e^x$ ,  $\log x$  and  $|x|$ .
- 2.2 Concept of limits. standard limits  $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a}$ ,  $\lim_{x \rightarrow 0} \frac{\sin x}{x}$ ,  $\lim_{x \rightarrow 0} \frac{a^x - 1}{x}$  and  $\lim_{x \rightarrow 0} (1 + x)^{\frac{1}{x}}$
- 2.3 Differentiation of trigonometric functions.
- 2.4 Differentiation of inverse trigonometric functions.

**3. COMPLEX NUMBERS**

- 3.1 Definition, Real and imaginary parts of a Complex number.
- 3.2 Addition, Subtraction, Multiplication and Division of a complex number
- 3.3 Introduction of De-moivre's theorem
- 3.4 Application of De-moivre's theorem

**4. PARTIAL FRACTIONS**

- 4.1 Definition of polynomial fraction, Proper & improper fractions.
- 4.2 Definition of partial fractions.
- 4.3 To resolve proper fraction into partial fraction with denominator containing Non-repeated linear factors
- 4.4 To resolve proper fraction into partial fraction with denominator containing repeated linear factors.

**5. PERMUTATIONS, COMBINATIONS AND BINOMIAL THEOREM**

- 5.1 Value of  ${}^n P_r$  and  ${}^n C_r$  and formula-based problems.
- 5.2 Problems based on General term.

**REFERENCES:**

1. Applied Mathematics Dr. D.KS. Rewar ,Dr. S. K. Sharma, O.P. Baheti
2. Applied Mathematics Dr. D.C. Gokhroo
3. Polytechnic Mathematics H. K. Dass
4. Text Book on Differential Calculus Chandrika Prasad
5. Text Book on Integral Calculus Chandrika Prasad
6. Differential Calculus M. Ray, S. S. Seth, & G. C. Sharma
7. Integral Calculus M. Ray, S. S. Seth, & G. C. Sharma
8. Calculus and Analytic Geometry B.S. Grewal, Khanna Publishers, New Delhi, 40th Edition, 2007
9. Engineering Mathematics, Reena Garg, Khanna Publishing House, New Delhi (Revised Ed. 2018)
10. Engineering Mathematics V. Sundaram, R. Balasubramanian, K.A. Lakshminarayanan, , 6/e.,  
Vikas Publishing House.
11. Advanced Engineering Mathematics Reena Garg & Chandrika Prasad, , Khanna Publishing House, New  
Delhi

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**APPLIED PHYSICS-I**

Course Code	1002
Course Title	Applied Physics-I
Number of Credits	5 (L-3,T-2, P-0)
Prerequisites	None
Course Category	Basic Science

**COURSE OBJECTIVES**

Applied Physics includes the study of a large number of diverse topics all related to materials/things that exist in the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which such objects behave. Concrete use of physical principles and analysis in various fields of engineering and technology are given prominence in the course content. The course will help the diploma engineers to apply the basic concepts and principles to solve broad-based engineering problems and to understand different technology based applications.

**COURSE OUTCOMES**

After undergoing this subject, the student will be able to:

1. Identify physical quantities, select their units for use in engineering solutions, and make measurements with accuracy by minimizing different types of errors.
2. Represent physical quantities as scalar and vectors and solve real life relevant problems.
3. Analyse type of motions and conservation of momentum principle to describe rocket propulsion, recoil of gun etc.
4. Define scientific work, energy and power and their units. Derive relationships for work, energy and power and solve related problems.
5. Describe forms of friction and methods to minimize friction between different surfaces.
6. State the principle of conservation of energy.
7. Compare and relate physical properties associated with linear motion and rotational motion and apply conservation of angular momentum principle to known problems.
8. Describe the phenomenon of surface tension, effects of temperature on surface tension and solve statics problems that involve surface tension related forces.
9. Describe the viscosity of liquids, coefficient of viscosity and the various factors affecting its value. Determine viscosity of an unknown fluid using Stokes' Law and the terminal velocity.
10. Define stress and strain. State Hooke's law and elastic limits, stress-strain diagram, determine the modulus of elasticity.
11. Illustrate the terms; heat and temperature, measure temperature in various processes on different scales (Celsius, Fahrenheit, and Kelvin etc.)
12. Distinguish between conduction, convection and radiation; identify different methods for reducing heat losses and mode of heat transfer between bodies at different temperatures.

**COURSE CONTENTS****1. PHYSICAL WORLD, UNITS AND MEASUREMENTS**

- 1.1 Physical quantities
  - 1.1.1 Fundamental and derived
  - 1.1.2 Dimensions and dimensional formulae of physical quantities
  - 1.1.3 Principle of homogeneity of dimensions
- 1.2 Measurements
  - 1.2.1 Measuring instruments, least count
  - 1.2.2 Types of measurement (direct, indirect)
- 1.3 Errors in measurements (systematic and random)
  - 1.3.1 Absolute error
  - 1.3.2 Relative error
  - 1.3.3 Significant figures.

**2. FORCE WORK AND ENERGY**

- 2.1 Force, Momentum- Statement and derivation of conservation of linear momentum
- 2.2 Applications such as recoil of gun, rockets
- 2.3 Work Concept and units
  - 2.3.1 Examples of zero work, positive work and negative work

- 2.4 Energy and its units
  - 2.4.1 Kinetic energy, Gravitational potential energy, and Mechanical energy
- 2.5 Conservation of mechanical energy for freely falling bodies
- 2.6 Power and its units
  - 2.6.1 Power and work relationship
  - 2.6.2 Calculation of power (numerical problems)

### 3. ROTATIONAL MOTION

- 3.1 Circular motion
  - 3.1.1 Definition of angular displacement
  - 3.1.2 Angular velocity, angular acceleration, frequency and time period
- 3.2 Centripetal and Centrifugal forces with live examples

### 4. PROPERTIES OF MATTER

- 4.1 Elasticity
  - 4.1.1 Definition of Stress and Strain
  - 4.1.2 Hooke's law and
- 4.2 Modulus of elasticity, Significance of stress-strain curve
- 4.3 Pressure
  - 4.3.1 Definition, units
  - 4.3.2 Atmospheric pressure, gauge pressure, absolute Pressure
- 4.4 Surface tension
  - 4.4.1 Cohesive and adhesive forces
  - 4.4.2 Angle of contact
- 4.5 Applications of surface tension
- 4.6 Effect of temperature and impurity on surface tension

### 5. HEAT AND THERMOMETRY

- 5.1 Concept of heat and temperature
- 5.2 Modes of heat transfer with examples (Conduction, Convection and Radiation)
- 5.3 Newton's law of cooling
- 5.4 Scales of temperature and their relationship
- 5.5 Types of Thermometer (Mercury, Platinum resistance thermometer, Pyrometer) and their uses

### REFERENCES

1. Text Book of Physics for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi
2. Applied Physics, Vol. I and Vol. II, TTTI Publications, Tata McGraw Hill, Delhi.
3. Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi
4. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
5. Engineering Physics by DK Bhattacharya&PoonamTandan; Oxford University Press, New Delhi.
6. Comprehensive Practical Physics, Vol. I & II, JN Jaiswal, Laxmi Publications (P) Ltd., New Delhi
7. Practical Physics by C. L. Arora, S. Chand Publication.
8. e-books/e-tools/ learning physics software/websites etc.
9. Engineering Physics by Gaur & Gupta.
10. Engineering Physics by S.L. Kakani& S. Kakani
11. Applied Physics Vol.-I by Hari Harlal, NITTTR
12. Applied Physics Vol.-II by Hari Harlal, NITTTR
13. A Text Book of Applied Physics by N.S. Kumar
14. Principles of Physics by Brijlal, Subhramanyam

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**APPLIED CHEMISTRY**

Course Code	BS 1003
Course Title	Applied Chemistry
Number of Credits	5 (L-3,T-2, P-0)
Prerequisites	None
Course Category	Basic Science

**COURSE OBJECTIVES**

There are numerous number materials are used in fabricating and manufacturing devices for the comfort of life. The selection, characterization and suitability assessment of natural raw materials essentially requires principles and concepts of Applied Chemistry for technicians. On successful completion of this course content will enable technicians to understand, ascertain and analyse and properties of natural raw materials require for producing economical and eco-friendly finished products.

1. Solve various engineering problems applying the basic knowledge of atomic structure and chemical bonding.
2. Use relevant water treatment method to solve domestic and industrial problems.
3. Solve the engineering problems using knowledge of engineering materials and properties.
4. Use relevant fuel and lubricants for domestic and industrial applications
5. Solve the engineering problems using concept of Electro chemistry and corrosion.

**COURSE OUTCOME**

At the end of the course student will be able to

1. Understand the classification and general properties of engineering materials such as metal, alloys, glasses, cement, refractory and composite materials using knowledge of chemical bonding.
2. Understand and assess the suitability of water source for domestic and industrial application, effluents and minimize water pollution.
3. Qualitatively analyze the engineering materials and understand their properties and applications.
4. Choose fuel and lubricants suitable for economical industrial processing to obtain eco-friendly finished products.
5. a) Ascertain construction, mechanism efficiency of electrochemical cells, solar cell fuel cells  
b) Understand corrosion and develop economical prevention techniques.

**COURSE CONTENTS****1. Atomic Structure, Chemical Bonding and Solutions:**

- 1.1 Hydrogen spectrum explanation based on Bohr's model of atom
- 1.2 Heisenberg uncertainty principle
- 1.3 Quantum numbers – Principal Quantum Numbers, azimuthal Quantum Numbers, Magnetic Quantum Numbers, Spin Quantum Numbers orbital concept with shape of orbitals
- 1.4 Aufbau rule, Electronic configuration.
- 1.5 Solution–idea of solute, solvent and solution, methods to express the concentration of solution- molarity (M = mole per litre), normality, molality, ppm, mass percentage, volume percentage, mole fraction and  $p^H$ .

**2. WATER**

- 2.1 Classification of soft and hard water based on soap test
- 2.2 Problems caused by the use of hard water in boiler (scale and sludge, foaming and priming, corrosion etc)
- 2.3 Water softening techniques
  - 2.3.1 Soda lime process
  - 2.3.2 Zeolite process
- 2.4 Municipal water treatment (in brief only)
  - 2.4.1 Sedimentation
  - 2.4.2 Coagulation
  - 2.4.3 Filtration
  - 2.4.4 Sterilization.

**3. ENGINEERING MATERIALS**

- 3.1 Natural occurrence of metals
  - 3.1.1 Minerals
  - 3.1.2 Ores of iron, aluminium and copper

- 3.1.3 Gangue (matrix)
- 3.1.4 Flux
- 3.1.5 Slag
- 3.1.6 Metallurgy - brief account of general principles of metallurgy.
- 3.2 Portland cement and hardening
- 3.3 Glasses
- 3.4 Refractory
- 3.5 Rubber \_Natural Rubber, Vulcanization of rubber

#### 4 CHEMISTRY OF FUELS AND LUBRICANTS

- 4.1 Definition of fuel
  - 4.1.1 Combustion of fuel,
  - 4.1.2 Classification of fuels
  - 4.1.3 Calorific values (HCV and LCV)
  - 4.1.4 Calculation of HCV and LCV using Dulong's formula
- 4.2 petrol and diesel - fuel rating (octane and cetane numbers)
- 4.3 Chemical properties of lubricants
  - 4.3.1.1 Coke number,
  - 4.3.1.2 Total acid number
  - 4.3.1.3 Saponification value

#### 5 ELECTRO CHEMISTRY

- 5.1 Faradays laws of electrolysis, Simple numerical problems.
- 5.2 Introduction to Corrosion of metals –
  - 5.2.1 Definition
  - 5.2.2 Types of corrosion (chemical and electrochemical)
- 5.3 H<sub>2</sub> liberation and O<sub>2</sub> absorption mechanism of electrochemical corrosion
- 5.4 Factors affecting rate of corrosion
- 5.5 Internal corrosion preventive measures –
  - Purification
  - Alloying
  - Heat treatment
- 5.6 External corrosion preventive measures-
  - metal (anodic, cathodic) coatings
  - organic inhibitors.

#### REFERENCES /SUGGESTED LEARNING RESOURCES:

##### (a) Books:

1. Text Book of Chemistry for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi, 2017-18.
2. Agarwal, & Shikha, Engineering Chemistry, Cambridge University Press; New Delhi, 2015.
3. C.N.R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.
4. Dara, S. S. &Dr.S.S.Umare, Engineering Chemistry, S.Chand. Publication, New Delhi, 2015.
5. Jain & Jain, Engineering Chemistry, Dhanpat Rai and Sons; New Delhi, 2015.
6. Dr.Vairam, S., Engineering Chemistry, Wiley India Pvt. Ltd., New Delhi, 2013.
7. Dr. G.H. Hugar& Prof A.N. Pathak, Applied Chemistry Laboratory Practices, Vol. I and Vol. II, NITTTR, Chandigarh, Publications, 2013-14.
8. Agnihotri, Rajesh, Chemistry for Engineers, Wiley India Pvt. Ltd., 20

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**COMMUNICATION SKILLS IN ENGLISH**

Course Code	1004
Course Title	Communication Skills in English
Number of Credits	3 (L-3, T-0, P-0)
Prerequisites	None
Course Category	Humanities & Science

**COURSE OBJECTIVES**

Communication skills play an important role in career development. This course aims at introducing basic concepts of communication skills with an emphasis on developing personality of the students. Thus, the main objectives of this course are:

1. To develop confidence in speaking English with correct pronunciation.
2. To develop communication skills of the students i.e. listening, speaking, reading and writing skills.
3. To introduce the need for personality development- focus will be on developing certain qualities which will aid students in handling personal and career challenges, leadership skills etc.

**COURSE OUTCOMES**

At the end of this course, the participants will:

1. Develop basic speaking and writing skills including proper usage of language and vocabulary so that they can become highly confident and skilled speakers and writers.
2. Be informed of the latest trends in basic verbal activities such as presentations, facing interviews and other forms of oral communication.
3. Also develop skills of group presentation and communication in team.
4. Develop non-verbal communication such as proper use of body language and gestures.

**COURSE CONTENTS****1 COMMUNICATION THEORY AND PRACTICE**

- 1.1 Basics of Communication: -
  - 1.1.1 Introduction
  - 1.1.2 Meaning and Definition
  - 1.1.3 Process of Communication
- 1.2 Types of Communication: -
  - 1.2.1 Formal and Informal
  - 1.2.2 Verbal and Non-verbal
- 1.3 Art of Effective Communication
  - 1.3.1 Choosing Words
  - 1.3.2 Voice and Modulation
  - 1.3.3 Framing of questions and answers

**2 SOFT SKILLS FOR PROFESSIONAL EXCELLENCE**

- 2.1 Introduction: Soft Skills and Hard Skills.
- 2.2 Applying Soft Skills across Cultures.

**3 READING COMPREHENSION**

Comprehension, vocabulary enhancement and grammar exercises based on reading of the following texts:

- 3.1 "The Blind Dog" (a story from Malgudi Days) by R.K. Narayan  
"The Gift of the Magi" (story) by O. Henry
- 3.2 "If" (poem) by Rudyard Kipling  
"Where the Mind is Without Fear" (poem) by Rabindranath Tagore

**4 PROFESSIONAL WRITING**

- 4.1 Letters: Formal letters
- 4.2 Job Application with CV
- 4.3 Drafting E-mail and Notice

**5 VOCABULARY AND GRAMMAR**



- 5.1 Types of Sentences with correct form of the verb
- 5.2 Active and Passive Voice
- 5.3 Modals (may, might, can, could, would, should, ought to, will, shall, must)

**REFERENCES**

1. Lindley Murray. An English Grammar: Comprehending Principles and Rules. London: Wilson and Sons, 1908.
2. 2. Kulbhushan Kumar, Effective Communication Skills, Khanna Publishing House, New Delhi (Revised Edition 2018)
3. Margaret M. Maison. Examine your English. Orient Longman: New Delhi, 1964.
4. M. Ashraf Rizvi. Effective Technical Communication. Mc-Graw Hill: Delhi, 2002.
5. John Nielson. Effective Communication Skills. Xlibris, 2008.
6. Oxford Dictionary
7. Collin's English Dictionary
8. Roget's Thesaurus of English Words and Phrases

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**ENGINEERING GRAPHICS**

Course Code	1005
Course Title	Engineering Graphics
Number of Credits	2 (L-0,T-0, P-4)
Prerequisites	None
Course Category	Engineering Science

**COURSE OBJECTIVES**

1. To understand the language of graphics which is used to express ideas, convey instructions while carrying out engineering jobs.
2. To develop drafting and sketching skills, to know the applications of drawing equipments, and get familiarize with Indian Standards related to engineering drawings.
3. To develop skills to visualize actual object or a part of it, on the basis of drawings.
4. To develop skills to translate ideas into sketches and to draw and read various engineering curves, projections and dimensioning styles.
5. To understand the basic commands and develop basic skills related to computer aided drafting, of how to draw, modify, and edit basic shapes (2D), using AUTOCAD.

**COURSE OUTCOMES**

1. Select and construct appropriate drawing scales, use drawing equipment's, and understand Indian Standards of engineering drawing
2. Draw views of given object and components
3. Sketch orthographic projections into isometric projections and vice versa.
4. Apply computer aided drafting tools to create 2D engineering drawings

**COURSE CONTENTS****1 BASIC ELEMENTS OF DRAWING**

- 1.1 Drawing Instruments and supporting materials: method to use them with applications.
- 1.2 Convention of lines and their applications.
- 1.3 Representative Fractions – reduced, enlarged and full size scales
- 1.4 Engineering Scales such as plain and diagonal scale.
- 1.5 Dimensioning techniques as per SP-46:2003.
- 1.6 Geometrical and Tangency constructions. (Redraw the figure)

**2 ORTHOGRAPHIC PROJECTIONS**

- 2.1 Introduction of projections-orthographic, perspective, isometric and oblique
  - 2.1.1 Concept and applications. (No question to be asked in examination).
- 2.2 Introduction to orthographic projection
  - 2.2.1 First angle and Third angle method, their symbols.
- 2.3 Conversion of pictorial view into Orthographic Views –
  - 2.3.1 object containing plain surfaces,
  - 2.3.2 Slanting surfaces,
  - 2.3.3 Slots,
  - 2.3.4 Ribs,
  - 2.3.5 Cylindrical surfaces. (Use First Angle Projection method only)

**3 ISOMETRIC PROJECTIONS**

- 3.1 Introduction to isometric projections.
- 3.2 Isometric scale and Natural scale.
- 3.3 Isometric view and isometric projection.
- 3.4 Illustrative problems related to objects containing lines, circles and arcs shape only.

**4 FREE HAND SKETCHES OF ENGINEERING ELEMENTS**

- 4.1 Free hand sketches of machine elements:
  - 4.1.1 Thread profiles
  - 4.1.2 Nuts
  - 4.1.3 Bolts
  - 4.1.4 Studs
  - 4.1.5 Set screws

- 4.1.6 Washer
- 4.1.7 Locking arrangements
- 4.2 Free hand sketches of orthographic view (on squared graph paper)
- 4.3 Free hand sketches of isometric view (on isometric grid paper)

## 5 COMPUTER AIDED DRAFTING INTERFACE

- 5.1 Computer Aided Drafting
  - 5.1.1 Concept
  - 5.1.2 Hardware and various CAD software available
  - 5.1.3 System requirements and Understanding the interface
- 5.2 Components of AutoCAD software window:
  - 5.2.1 Title bar
  - 5.2.2 Standard tool bar
  - 5.2.3 Menu bar
  - 5.2.4 Object properties tool bar
  - 5.2.5 Draw tool bar
  - 5.2.6 Modify tool bar
  - 5.2.7 Cursor cross hair
  - 5.2.8 Command window
  - 5.2.9 Status bar
  - 5.2.10 drawing area
  - 5.2.11 UCS icon
- 5.3 File features:-
  - 5.3.1 New file
  - 5.3.2 Saving the file
  - 5.3.3 Opening an existing drawing file
  - 5.3.4 Creating templates
  - 5.3.5 Quit
- 5.4 Setting up new drawing:-
  - 5.4.1 Units
  - 5.4.2 Limits
  - 5.4.3 Grid
  - 5.4.4 Snap
  - 5.4.5 Undoing and redoing action.

## 6 COMPUTER AIDED DRAFTING

- 6.1 Draw basic entities like Line, Circle, Arc, Polygon, Ellipse, Rectangle, Multiline, PolyLine
- 6.2 Method of specifying points: Absolute coordinates, Relative Cartesian and Polar coordinates.
- 6.3 Modify and edit commands like trim, extend, delete, copy, offset, array, block, layers.
- 6.4 Dimensioning: Linear, Horizontal Vertical, Aligned, Rotated, Baseline, Continuous, Diameter, Radius, Angular Dimensions
- 6.5 Dim scale variable.
- 6.6 Editing dimensions.
- 6.7 Text: Single line Text, Multiline text.
- 6.8 Standard sizes of sheet.
- 6.9 Selecting various plotting parameters such as Paper size, paper units, Drawing orientation, plot scale, plot offset, plot area, print preview.

S. No.	Practical Exercises	Unit No.	Approx. Hrs
1	Draw horizontal, Vertical, 30 degree, 45 degree, 60 and 75 degrees lines, different types of lines, dimensioning styles using set squares and drafter.	I	02
2	Write Single stroke alphabets and numerical (vertical only)	I	02
3	Draw regular polygons and conic sections.	I	02
4	Draw cycloid, involute and Archimedian spiral.	I	02
5	Draw a problem on orthographic projections using first angle method of projection having plain surfaces and slanting.	II	02
6	Draw two problems on orthographic projections using first angle method of projection	II	04

	having slanting surfaces with slots.		
7	Draw two problems on orthographic projections using first angle method of projection having cylindrical surfaces, ribs.	II	04
8	Draw two problems on Isometric view of simple objects having plain and slanting surface by using natural scale.	III	02
9	Draw two problems on Isometric projection of simple objects having cylindrical surface by using isometric scale.	III	04
10	Draw free hand sketches/ conventional representation of machine elements such as thread profiles, nuts, bolts, studs, set screws, washers, Locking arrangements.	IV	02
11	Draw basic 2D entities like: Rectangle, Rhombus, Polygon using AutoCAD	VI	02
12	Draw basic 2D entities like: Circles, Arcs, circular using AutoCAD	VI	02
13	Draw basic 2D entities like: Circular and rectangular array using AutoCAD	VI	02
14	Draw blocks of 2D entities comprises of Rectangle, Rhombus, Polygon, Circles, Arcs, circular and rectangular array, blocks using AutoCAD	VI	04
15	Draw basic branch specific components in 2D using AutoCAD	VI	04
16	Draw complex branch specific components in 2D using AutoCAD	VI	04
	Total		44

### SUGGESTED LEARNING RESOURCES

1. Bureau of Indian Standards. Engineering Drawing Practice for Schools and Colleges IS: Sp-46. BIS. Government of India, Third Reprint, October 1998; ISBN: 81-7061-091-2.
2. Bhatt, N. D. Engineering Drawing. Charotar Publishing House, Anand, Gujrat 2010; ISBN: 978-93- 80358-17-8.
3. Jain & Gautam, Engineering Graphics & Design, Khanna Publishing House, New Delhi (ISBN: 978- 93-86173-478)
4. Jolhe, D. A. Engineering Drawing. Tata McGraw Hill Edu. New Delhi, 2010; ISBN: 978-0-07- 064837-1
5. Dhawan, R. K. Engineering Drawing. S. Chand and Company, New Delhi; ISBN: 81-219-1431-0.
6. Shah, P. J. Engineering Drawing. S. Chand and Company, New Delhi, 2008, ISBN:81-219-2964-4.
7. Kulkarni, D. M.; Rastogi, A. P.; Sarkar, A. K. Engineering Graphics with AutoCAD. PHI Learning Private Limited-New Delhi (2010); ISBN: 978-8120337831.
8. Jeyapooan, T. Essentials of Engineering Drawing and Graphics using AutoCAD. Vikas Publishing House Pvt. Ltd, Noida, 2011; ISBN: 978-8125953005.
9. Autodesk. AutoCAD User Guide. Autodesk Press, USA, 2015. 10. Sham, Tickoo. AutoCAD 2016 for Engineers and Designers. Dreamtech Press; Galgotia Publication, New Delhi, 2015; ISBN 978-9351199113.
10. Gill P.S., Machine Drawing, SK Kataria & Sons, New Delhi
11. Laxminarayan & Mathur M.L., A text book of Machine Drawing , Jain Brother, New Delhi
12. Goyal B. K., Engineering Drawing (Hindi), Asian Publishers, Muzaffarnagar

### Software/LearninG Websites

1. <https://www.youtube.com/watch?v=TJ4jGyD-WCw>
2. [https://www.youtube.com/watch?v=dmt6\\_n7Sgcg](https://www.youtube.com/watch?v=dmt6_n7Sgcg)
3. [https://www.youtube.com/watch?v=\\_MQScnLXL0M](https://www.youtube.com/watch?v=_MQScnLXL0M)
4. <https://www.youtube.com/watch?v=3WXPanCq9LI>
5. <https://www.youtube.com/watch?v=fvjk7PlxAuo>
6. <http://www.me.umn.edu/coursesme2011/handouts/engg%20graphics.pdf>
7. <https://www.machinedesignonline.com>

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**ENGINEERING WORKSHOP PRACTICE**

Course Code	1006
Course Title	Engineering Workshop Practice
Number of Credits	2 (L-0,T-0, P-4)
Prerequisites	None
Course Category	Engineering Science

**COURSE OBJECTIVES**

1. To understand basic engineering processes for manufacturing and assembly.
2. To understand, identify, select and use various marking, measuring, and holding, striking and cutting tools and equipments.
3. To understand and interpret job drawings, produce jobs, and inspect the job for specified dimensions.
4. To understand, operate, control different machines and equipment's adopting safety practices

**COURSE OUTCOMES**

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

1. Acquire skills in basic engineering practice to identify, select and use various marking, measuring, and holding, striking and cutting tools & equipment's and machines
2. Understand job drawing and complete jobs as per specifications in allotted time
3. Inspect the job for the desired dimensions and shape
4. Operate, control different machines and equipment's adopting safety practices

**Details of Practical Contents****1.1 CARPENTRY**

- 1.2 Demonstration of different wood working tools / machines.
- 1.3 Demonstration of different wood working processes, like planing, marking, chiseling, grooving, turning of wood etc.
- 1.4 One simple job involving any one joint like mortise and tenon, dovetail, bridle and half lap.

**2. FITTING**

- 2.1 Demonstration of different fitting tools and drilling machines and power tools
- 2.2 Demonstration of different operations like filing, drilling, tapping, sawing, cutting etc.
- 2.3 One simple fitting job involving practice of cutting, filing, marking, hacksawing, drilling, tapping, etc.

**3. WELDING**

- 3.1 Demonstration of different welding tools / machines.
- 3.2 Demonstration on Arc Welding, Gas Welding, MIG welding, gas cutting and rebuilding of broken parts with welding.
- 3.3 One simple job involving butt and lap joint using electric arc welding.

**4. SHEET METAL WORKING**

- 4.1 Demonstration of different sheet metal tools / machines.
- 4.2 Demonstration of different sheet metal operations like sheet cutting, bending, edging, end curling, lancing, soldering, brazing, and riveting.
- 4.3 One simple job involving sheet metal operations, soldering and riveting.

**5. PLUMBING**

- 5.1 Demonstration of different plumbing tools, accessories, valves and different pipe fittings and joints (GI and PVC).
- 5.2 Demonstration of different plumbing operations like cutting, threading, pipe fitting (GI and PVC).
- 5.3 One simple job involving pipecutting and external thread cutting on GI pipe.

**REFERENCES:**

1. S.K. Hajara Chaudhary, Workshop Technology, Media Promoters and Publishers, New Delhi, 2015
2. B.S. Raghuvanshi, Workshop Technology, Dhanpat Rai and sons, New Delhi 2014
3. K. Venkat Reddy, Workshop Practice Manual, BS Publications, Hyderabad 2014
4. Kents Mechanical Engineering Hand book, John Wiley and Sons, New York
5. Roop Lal and Bharadwaj P. K., PrarambhikKaryashalaTakneeki (Hindi), Vayu Education of India, New Delhi

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**APPLIED PHYSICS-I LAB**

Course Code	1007
Course Title	Applied Physics-I Lab
Number of Credits	1 (L-0,T-0, P-2)
Prerequisites	None
Course Category	Basic Science

**COURSE OBJECTIVES**

Study of Applied Physics aims to give an understanding of physical world by observations and predictions. Concrete use of physical principles and analysis in various fields of engineering and technology is very prominent. The course aims to supplement the factual knowledge gained in the lecture by first hand manipulation of apparatus. This will develop scientific temper and help to apply the basic concepts and principles in solving engineering and technology based problems. In addition, students get necessary confidence in handling equipment and thus learn various skills in measurement.

**COURSE OUTCOMES**

After undergoing this lab work, the student will be able to:

1. Select right kind of measuring tools (Meter scale, Vernier caliper, Screw gauge, Spherometer etc.) for determining dimensions of physical quantities and make measurements with accuracy and precision.
2. Differentiate various shapes and determine dimensions of plane, curved and regular surfaces/bodies. Apply and Verify laws of forces and determine resultant force acting on a body.
3. Appreciate role of friction and measure co-efficient of friction between different surfaces.
4. Describe and verify Hook's law and determine force constant of spring body.
5. Identify various forms of energy and verify law of conservation of energy.
6. Understand rotational motion and determine M.I. of a rotating body (flywheel)
7. Understand Stoke's law for viscous liquids and determine viscosity of a given liquid.
8. Understand use of thermometers to measure temperature under different conditions and different scales of temperature measurements.

**LIST OF PRACTICALS/ACTIVITIES (Minimum 8 practicals must be performed)**

1. To measure length, radius of a given cylinder, a test tube and a beaker using a Vernier caliper and find volume of each object.
2. To determine diameter of a wire, a solid ball and thickness of cardboard using a screw gauge.
3. To determine radius of curvature of a convex and a concave mirror/surface using a Spherometer.
4. To verify triangle and parallelogram law of forces.
5. To find the co-efficient of friction between wood and glass using a horizontal board.
6. To determine force constant of a spring using Hook's Law.
7. To verify law of conservation of mechanical energy (PE to KE).
8. To find the viscosity of a given liquid (Glycerin) by Stoke's law.
9. To measure room temperature and temperature of a hot bath using mercury thermometer and convert it into different scales.
10. To verify Newton's law of cooling.

**SUGGESTED STUDENT ACTIVITIES & STRATEGIES**

Apart from classroom and laboratory learning following are the suggested student related activities which can be undertaken to accelerate the attainment of various outcomes of the course

1. Survey of different physical products and comparison on the basis of the following points
  - 1.1. Measurements of dimensions
  - 1.2. Properties
  - 1.3. Applications
2. Library survey regarding engineering materials/products used in different industries
3. Seminar on any relevant topic.

Teachers should use the following strategies to achieve the various outcomes of the course.

1. Different methods of teaching and media to be used to attain classroom attention.
2. Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
3. 15-20% of the topics which are relatively simpler or descriptive in nature should be given to the students for self-learning and assess the development of competency through classroom presentations.
4. Micro-projects may be given to group of students for hand-on experiences.

**REFERENCES:**

1. Text Book of Physics for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi
2. Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publications (P)Ltd.,
3. Practical Physics by C. L. Arora, S. Chand Publication.
4. e-books/e-tools/ learning physics software/YouTube videos/websites etc.

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**APPLIED CHEMISTRY LAB**

Course Code	1008
Course Title	Applied Chemistry Lab
Number of Credits	1 (L-0,T-0, P-2)
Prerequisites	None
Course Category	Basic Science

**COURSE OBJECTIVES**

There are numerous number of materials used in fabricating and manufacturing devices for the comfort of life. The selection, characterization and suitability assessment of natural raw materials essentially requires principles and concepts of Applied Chemistry for technicians. The course aims to supplement the factual knowledge gained in the lectures by first hand manipulation of processes and apparatus. This will develop scientific temper and help to apply the basic concepts and principles in solving engineering problems.

**COURSE OUTCOMES**

At the end of the course student will be able to

1. To express quantitative measurements accurately.
2. To practice and adapt good measuring techniques.
3. To use various apparatus for precise measurements.
4. To understand and differentiate different methods of quantitative analysis.
5. To know and understand principles of quantitative analysis using instruments.
6. To construct different electrochemical cells used in developing batteries.
7. To understand and appreciate methods of corrosion abetments.

**LIST OF PRACTICALS/ACTIVITIES** (Minimum 10 practicals must be performed)

Perform any 10 (ten) Laboratory Practical's.

**VOLUMETRIC AND GRAVIMETRIC ANALYSIS:**

1. Identification of Acid and Basic Radicals in a salt.
2. Preparation of standard solution of oxalic acid or potassium permanganate.
3. To determine strength of given sodium hydroxide solution by titrating against standard oxalic acid solution using phenolphthalein indicator.
4. To determine the strength of Ferrous Sulphate using standard Ferrous Ammonium Sulphate and Potassium Dichromate as intermediate solution.
5. To determine of strength of Hydrochloric acid solution by titrating against sodium hydroxide using methyl orange indicator.
6. Volumetric estimation of total acid number (TAN) of given oil.
7. Volumetric estimation of
  - a) Total hardness of given water sample using standard EDTA solution.
  - b) Alkalinity of given water sample using 0.01M sulphuric acid
8. Proximate analysis of coal
  - a) Gravimetric estimation moisture in given coal sample
  - b) Gravimetric estimation ash in given coal sample

**INSTRUMENTAL ANALYSIS**

9. Determine the conductivity of given water sample.
10. Determination of the Iron content in given cement sample using colorimeter.
11. Determination of calorific value of solid or liquid fuel using bomb calorimeter.
12. Determination of viscosity of lubricating oil using Redwood viscometer.
13. Determination of flash and fire point of lubricating oil using Able's flash point apparatus.
14. To verify the first law of electrolysis of copper sulphate using copper electrode.
15. Construction and measurement of emf of electrochemical cell (Daniel cell).
16. Determination of PH values of given samples using digital PH meter.
17. Determination of melting point and boiling point of compounds using Thiele tube method.

**Teachers should use the following strategies to achieve the various outcomes of the course.**

1. Different methods of teaching and media to be used to attain classroom attention.
2. Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
3. 15-20% of the topics which are relatively simpler of descriptive in nature should be given to the students for self-learning and assess the development of competency through classroom presentations.



4. Micro-projects may be given to group of students for hand-on experiences
5. Encouraging students to visit to sites such as Railway station and research establishment around the institution.

**REFERENCE BOOKS**

1. Text Book of Chemistry for Class XI & XII (Part-I, Part-II); N.C.E.R.T., Delhi, 2017-18.
2. Dr.G.H.Hugar and Prof A. N. Pathak, Applied Chemistry Laboratory Practices, Vol. I and Vol. II, NITTTR, Chandigarh, Publications, 2013-14.
3. Agnihotri, Rajesh, Chemistry for Engineers, Wiley India Pvt.Ltd. 2014.
4. Jain & Jain, Engineering Chemistry, Dhanpat Rai and Sons; New Delhi, 2015.

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**COMMUNICATION SKILLS IN ENGLISH - LAB**

Course Code	1009
Course Title	Communication Skills in English – Lab
Number of Credits	1 (L-0,T-0, P-2)
Prerequisites	None
Course Category	Humanities & Science

**COURSE OBJECTIVES**

Communication skills play an important role in career development. This lab course aims at actively involving students in various activities to improve their communication skills with an emphasis on developing personality of the students. Thus, the objectives of this course are:

1. To develop listening skills for enhancing communication.
2. To develop speaking skills with a focus on correct pronunciation and fluency.
3. To introduce the need for personality development- focus will be on developing certain qualities which will aid students in handling personal and career challenges, leadership skills etc. for that purpose group discussion, extempore and other activities should be conducted during lab classes.

**COURSE OUTCOMES**

At the end of this course the students will be able

1. To communicate effectively with an increase in their confidence to read, write and speak English fluently.
2. They will also demonstrate a significant increase in word power.
3. The variety of exercises and activities that will be conducted in the Language Lab will develop their skills needed to participate in a conversation like listening carefully and respectfully to others' viewpoints; articulating their own ideas and questions clearly and over all students will be able to prepare, organize, and deliver an engaging oral presentation.
4. They will also develop non-verbal communication such as proper use of body language and gestures.

**COURSE CONTENTS****1. LISTENING SKILLS**

- 1.1 Listening Process and Practice
- 1.2 Listening to Recorded Lectures / Dialogues / Poems / Interviews and Speeches etc.

**2. INTRODUCTION TO PHONETICS**

- 2.1 Sounds: - Consonants, Vowels (Monophthongs and Diphthongs)
- 2.2 Transcription of Words (IPA), Syllable Division and Word Stress

**3. SPEAKING SKILLS**

- 3.1 Formal Speech and Public Speaking
- 3.2 Presentation Skills
- 3.3 Conversation Practices in various situations such as asking address, enquiries and at places such as retail shop, service centre, bank, customer care, etc. (role-play based)

**4. PROFESSIONAL SKILLS**

- 4.1 Group Discussion
- 4.2 Telephonic Conversation and Video Conferencing
- 4.3 Mock Interview
- 4.4 Personal Grooming (manners and etiquettes, appearance, hygiene, gestures, postures etc.)

**5. BUILDING VOCABULARY**

- 5.1 Word-formation
- 5.2 Phrasal Verbs, Foreign Phrases, Idioms and Phrases
- 5.3 Word Games such as crosswords, scrabble, quiz, spell-it etc. (to enhance self-expression and vocabulary of participants)

**RECOMMENDED READINGS**

1. Daniel Jones. The Pronunciation of English. Cambridge: Cambridge University Press, 1956.
2. James Hartman & et al. Ed. English Pronouncing Dictionary. Cambridge: Cambridge University
3. 3. Kulbhushan Kumar, Effective Communication Skills, Khanna Publishing House, New Delhi (Revised Ed. 2018)
4. J.D.O'Connor. Better English Pronunciation. Cambridge: Cambridge University Press, 1980.
5. Lindley Murray. An English Grammar: Comprehending Principles and Rules. London: Wilson and Sons, 1908.

6. Margaret M. Maison. Examine your English. Orient Longman: New Delhi, 1964.
7. J.Sethi& et al. A Practice Course in English Pronunciation. New Delhi: Prentice Hall, 2004.
8. Pfeiffer, William Sanborn and T.V.S Padmaja. Technical Communication: A Practical Approach. 6th ed. Delhi: Pearson, 2007

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**SPORTS AND YOGA**

Course Code	1010
Course Title	Sports & Yoga
Number of Credits	1 (L-0,T-0, P-2)
Prerequisites	None
Course Category	Humanities & Science

**COURSE OBJECTIVES**

1. To make the students understand the importance of sound health and fitness principles as they relate to better health.
2. To expose the students to a variety of physical and yogic activities aimed at stimulating their continued inquiry about Yoga, physical education, health and fitness.
3. To create a safe, progressive, methodical and efficient activity based plan to enhance improvement and minimize risk of injury.
4. To develop among students an appreciation of physical activity as a lifetime pursuit and a means to better health.

**COURSE OUTCOMES**

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

1. Practice Physical activities and Hatha Yoga focusing on yoga for strength, flexibility, and relaxation.
2. Learn techniques for increasing concentration and decreasing anxiety which leads to stronger academic performance.
3. Learn breathing exercises and healthy fitness activities
4. Understand basic skills associated with yoga and physical activities including strength and flexibility, balance and coordination.
5. Perform yoga movements in various combination and forms.
6. Assess current personal fitness levels.
7. Identify opportunities for participation in yoga and sports activities.
8. Develop understanding of health-related fitness components: cardio respiratory endurance, flexibility and body composition etc.
9. Improve personal fitness through participation in sports and yogic activities.
10. Develop understanding of psychological problems associated with the age and lifestyle.
11. Demonstrate an understanding of sound nutritional practices as related to health and physical performance.
12. Assess yoga activities in terms of fitness value.
13. Identify and apply injury prevention principles related to yoga and physical fitness activities.
14. Understand and correctly apply biomechanical and physiological principles related to exercise and training.

**COURSE CONTENT:****UNIT-I****1. INTRODUCTION TO PHYSICAL EDUCATION**

- 1.1 Meaning & definition of Physical Education
- 1.2 Aims & Objectives of Physical Education

**2. YOGA**

- 2.1 Meaning & Importance of Yoga
- 2.2 Elements of Yoga
- 2.3 Introduction - Asanas, Pranayama, Meditation & Yogic Kriyas
- 2.4 Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana&Shashankasana)

**UNIT-II****3. OLYMPIC MOVEMENT**

- 3.1 Olympic Symbols, Ideals, Objectives & Values
- 3.2 Awards and Honours in the field of Sports in India (Dronacharya Award, Arjuna Award, Dhyanchand Award, Rajiv Gandhi Khel Ratna Award etc.)

**4. PHYSICAL FITNESS, WELLNESS & LIFESTYLE**

- 4.1 Meaning & Importance of Physical Fitness & Wellness
- 4.2 Components of Physical fitness & wellness
- 4.3 Concept of Positive Lifestyle

**UNIT-II****5. YOGA & LIFESTYLE**

- 5.1 Asanas as preventive measures.
- 5.2 Hypertension: Tadasana, Vajrasana, Pawanuktasana.
- 5.3 Obesity: Procedure, Benefits & contraindications for Vajrasana, Hastasana.
- 5.4 Back Pain: Tadasana, Ardhamatsyendrasana, Vakrasana.
- 5.5 Diabetes: Procedure, Benefits & contraindications for Bhujangasana, Paschimottasana.
- 5.6 Asthma: Procedure, Benefits & contraindications for Sukhasana, Chakrasana,

**UNIT-III****6. FUNDAMENTALS OF ANATOMY & PHYSIOLOGY IN PHYSICAL EDUCATION, SPORTS AND YOGA**

- 6.1 Define Anatomy, Physiology & Its Importance
- 6.2 Effect of exercise on the functioning of Various Body Systems.
  - 6.2.1 Circulatory System,
  - 6.2.2 Respiratory System,

**7. POSTURES**

- 7.1 Meaning and Concept of Postures
- 7.2 Causes of Bad Posture
- 7.3 Advantages & disadvantages of weight training

**UNIT-IV****8. TRAINING AND PLANNING IN SPORTS**

- 8.1 Meaning of Training o Warming up and limbering down

**9. PSYCHOLOGY & SPORTS**

- 9.1 Definition & Importance of Psychology in Physical Edu. & Sports
- 9.2 Define & Differentiate Between Growth & Development

**10. DOPING**

- 10.1 Meaning and Concept of Doping

**11. SPORTS MEDICINE**

- 11.1 First Aid – Definition, Aims & Objectives.
- 11.2 Sports injuries: Classification, Causes & Prevention.

**UNIT-V****12. SPORTS / GAMES**

Following sub topics related to any one Game/Sport of choice of student out of: Athletics, Badminton, Basketball, Chess, Cricket, Kabaddi, Lawn Tennis, Swimming, Table Tennis, Volleyball, Yoga etc.

- 12.1 History of the Game/Sport. o Latest General Rules of the Game/Sport.
- 12.2 Specifications of Play Fields and Related Sports Equipment.
- 12.3 Important Tournaments and Venues.

**REFERENCES:**

1. Modern Trends and Physical Education by Prof. Ajmer Singh.
2. Light On Yoga By B.K.S. Iyengar.
3. Health and Physical Education – NCERT (11th and 12th Classes)

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GOVERNMENT OF RAJASTHAN  
**BOARD OF TECHNICAL EDUCATION RAJASTHAN, JODHPUR**  
**TEACHING AND EXAMINATION SCHEME**  
**FOR DIPLOMA II SEMESTER (COMMON FOR ALL ENGINEERING BRANCHES)**  
**SEMESTER SCHEME, SESSION 2020-2021 & ONWARDS**

Subject Category	Subject Code.	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks	Credits
			Hours per week				End Semester Exam				Internal Assessment				
			L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU	PR(S)		
BS	2001	Mathematics-II	3	2	0	5	60	3	--	--	20	20	--	100	5
BS	2002	Applied Physics-II	3	1	0	4	60	3	--	--	20	20	--	100	4
ES	2003	Introduction to IT Systems	3	0	0	3	60	3	--	--	40	--	--	100	3
ES	2004	Fundamentals of Electrical & Electronics Engineering	2	2	0	4	60	3	--	--	20	20	--	100	4
ES	2005	Engineering Mechanics	3	1	0	4	60	3	--	--	20	20	--	100	4
BS	2006	Applied Physics-II Lab	0	0	2	2	--	--	40	3	--	--	60	100	1
ES	2007	Introduction to IT Systems Lab	0	0	4	4	--	--	40	3	--	--	60	100	2
ES	2008	Fundamentals of Electrical & Electronics Engineering Lab	0	0	4	4	--	--	40	3	--	--	60	100	2
ES	2009	Engineering Mechanics Lab	0	0	2	2	--	--	40	3	--	--	60	100	1
AU	**2010	Environmental Sciences	2	0	0	2	--	--	--	--	--	--	--	--	0
VS	2011	<b>Anandam (Joy of Giving)</b>	--	--	<b>1</b>	<b>1</b>	--	--	--	--	--	--	<b>100</b>	<b>100</b>	<b>2</b>
		<b>Students Centered Activities*</b>	--	--	<b>1</b>	<b>1</b>	--	--	--	--	--	--	--	--	--
		<b>Total</b>	<b>16</b>	<b>6</b>	<b>14</b>	<b>36</b>	<b>300</b>	--	<b>160</b>		<b>120</b>	<b>80</b>	<b>240</b>	<b>1000</b>	<b>28</b>
<b>Grand Total :</b>													<b>1000</b>	<b>28</b>	

1. L : Lecture

2. T : Tutorial

3. P : Practical

4. TH : Marks for End Semester Exam for Theory

5. PR : Marks for End Semester Exam for Practical

6. CT : Marks for class tests (Internal Assessment)

7. TU : Marks for tutorials (Internal Assessment)

8. PR(S) : Marks for practical and viva (Internal Assessment)

**BS: Basic Science, HS: Humanities Science, ES: Engineering Science AU: Audit Course VS: Value Studies**

**Anandam (Joy of Giving):** In addition to the practical of one hour every week, students will have to do activities at home and college after college hours.

**\* Student Centered Activities include** 1. Expert lectures/ practice sessions on technical topics of common interest 2. Personality development 3. Human values 4. Industrial visits 5. Art of living 6. Environmental issues 7. Quiz programs 8. Interview techniques 9. Greening and cleaning of campus etc.

Student Centered Activities will be graded as A, B, C & D on the basis of attendance and interest of the student in learning.

**\*\*2010 Environmental Sciences** is an Audit Course so will not be considered for Credit / CGPA.

**NOTE:** Students will go for one month (24 Working Days) Summer Internship in the Summer Vacations after Second Semester. The Assessment of the Summer Internship will be done in Third Semester.

**MATHEMATICS- II**

Course Code	2001
Course Title	Mathematics-II
Number of Credits	5(L-3, T-2,P-0)
Prerequisites	None
Course Category	Basic Science

**COURSE OBJECTIVES**

This course is designed to give a comprehensive coverage at an introductory level to the subject of Matrices, Integral Calculus, Coordinate Geometry, Basic elements of vector algebra and First Order Differential Equations.

**COURSE OUTCOMES**

By the end of the course the students are expected to learn

1. The students are expected to acquire necessary background in Determinants and Matrices so as to appreciate the importance of the Determinants.
2. The Basic concepts of Integration and Differential equations and able to apply them in Engineering problems.
3. The coordinate geometry provides a connection between algebra and geometry through graphs of lines and curves.
4. The concept of Vectors and able to apply them in Engineering problems.

**COURSE CONTENT****1. DETERMINANTS AND MATRICES**

- 1.1 Algebra of matrices.
- 1.2 Elementary properties of determinants up to 3rd order.
- 1.3 Consistency of equations, Cramer's rule.
- 1.4 Inverse of a matrix.
- 1.5 Inverse Matrix method to solve a system of linear equations in 3 variables.

**2. INTEGRAL CALCULUS AND DIFFERENTIAL EQUATIONS**

- 2.1 Integration as inverse operation of differentiation.
- 2.2 Simple integration by substitution, by parts and by partial fractions (for linear factors only).
- 2.3 Use of formulas  $\int_0^{\pi/2} \sin^m x \cos^n x dx$  for solving problems where m and n are positive integers.
- 2.4 Definition of Differential Equation, Order and Degree of Differential Equation

**3. TWO-DIMENSIONAL CO-ORDINATE GEOMETRY**

- 3.1 General Introduction, Distance formula and section formula.
- 3.2 Equation of straight line in various standard forms.
  - 3.2.1 Slope form, Intercept form, Perpendicular form.
  - 3.2.2 One-point slope form, Two-point form, General form (without proof).
- 3.3 Angle between two lines, Parallel and perpendicular lines.
- 3.4 Perpendicular distance formula.

**4. CIRCLE AND CONICS**

- 4.1 General equation of a circle and its characteristics.
- 4.2 To find the equation of a circle, given:
  - 4.2.1 Centre and radius,
  - 4.2.2 Three points lying on it
  - 4.2.3 Coordinates of end points of a diameter

**5. VECTOR ALGEBRA**

- 5.1 Definition notation and rectangular resolution of a vector.
- 5.2 Addition and subtraction of vectors.

**REFERENCES:**

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 40th Edition, 2007.
2. G. B. Thomas, R. L. Finney, Calculus and Analytic Geometry, Addison Wesley, 9th Edition, 1995.
3. S.S. Sabharwal, Sunita Jain, Eagle Parkashan, Applied Mathematics, Vol. I & II, Jalandhar.
4. Comprehensive Mathematics, Vol. I & II by Laxmi Publications, Delhi.
5. Reena Garg & Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishing House, New Delhi

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**APPLIED PHYSICS –II**

<b>Course Code</b>	<b>2002</b>
<b>Course Title</b>	<b>Applied Physics-II</b>
<b>Number of Credits</b>	<b>4 (L-3,T-1,P-0)</b>
<b>Prerequisites</b>	<b>None</b>
<b>Course Category</b>	<b>Basic Science</b>

**COURSE OBJECTIVES**

Applied Physics aims to give an understanding of this world both by observation and by prediction of the way in which objects behave. Concrete use of physical principles and analysis in various fields of engineering and technology are given prominence in the course content. The course will help the diploma engineers to apply the basic concepts and principles to solve broad-based engineering problems and to understand different technology based applications.

**COURSE OUTCOMES**

After undergoing this subject, the student will be able to

1. Describe waves and wave motion, periodic and simple harmonic motions and solve simple problems. Establish wave parameters: frequency, amplitude, wavelength, and velocity.
2. State basic optical laws, establish the location of the images formed by mirrors and thin converging lens, design and assemble microscope using lenses combination.
3. Describe refractive index of a liquid or a solid and will be able to explain conditions for total internal reflection.
4. Define capacitance and its unit, explain the function of capacitors in simple circuits, and solve simple problems.
5. Differentiate between insulators, conductors and semiconductors, and define the terms: potential, potential difference, electromotive force.
6. Express electric current as flow of charge, concept of resistance, measure of the parameters: electric current, potential difference, resistance.
7. List the effects of an electric current and its common applications, State Ohm's law, calculate the equivalent resistance of a variety of resistor combinations, distinguish between AC and DC currents, determine the energy consumed by an appliance,
8. State the laws of electromagnetic induction; describe the effect on a current-carrying conductor when placed in a magnetic field.
9. Explain the operation of appliances like moving coil galvanometer, simple DC motors.
10. Apply the knowledge of diodes in rectifiers. Use the knowledge of semiconductors in various technical gadgets like photocells, solar lights etc.
11. Illustrate the conditions for light amplification in various LASER and laser based instruments and optical devices.
12. Appreciate the potential of optical fiber in fields of medicine and communication.
13. Express importance of nanoscience and nanotechnology and impact of nanotechnology to the society.

**Teaching Approach**

1. Teachers should give examples from daily routine as well as, engineering/technology applications on various concepts and principles in each topic so that students are able to understand and grasp these concepts and principles. In all contents, SI units should be followed.
2. Use of demonstration can make the subject interesting and develop scientific temper in the students. Student activities should be planned on all the topics.
3. Activity- Theory - Demonstrate/practice approach may be followed throughout the course so that learning may be outcome and employability based

**COURSE CONTENTS****1. WAVE MOTION AND ITS APPLICATIONS**

- 1.1 Wave motion
- 1.2 Transverse and longitudinal waves with examples
- 1.3 Definitions of wave velocity, frequency and wave length and their relationship
- 1.4 Principle of superposition of waves
- 1.5 Stationary waves and Resonance tube
- 1.6 Simple Harmonic Motion (SHM):

- 1.6.1 Definition.
- 1.6.2 Simple harmonic progressive wave and energy transfer

**2. OPTICS**

- 2.1 Basic optical laws
  - 2.1.1 Reflection and refraction
  - 2.1.2 Lens formula, power of lens (only formula)
- 2.2 Total internal reflection
  - 2.2.1 Critical angle and conditions for total internal reflection
  - 2.2.2 Applications of total internal reflection in optical fiber
- 2.3 Optical Instruments
  - 2.3.1 Simple and compound microscope (introduction and uses)

**3. ELECTROSTATICS AND CURRENT ELECTRICITY**

- 3.1 Coulombs law, Unit of charge
- 3.2 Electric field, Electric lines of force and their properties
- 3.3 Electric flux
- 3.4 Electric Current and its units
  - 3.4.1 Direct and alternating current
- 3.5 Kirchhoff's law
- 3.6 Wheatstone bridge and its applications (meter bridge)
- 3.7 Concept of terminal potential difference and Electro motive force (EMF)

**4. ELECTROMAGNETISM**

- 4.1 Magnetic field and its units
  - 4.1.1 Magnetic intensity
  - 4.1.2 Magnetic lines of force
  - 4.1.3 Magnetic flux and units
- 4.2 Concept of electromagnetic induction
  - 4.2.1 Faraday's Laws and Lenz's law
- 4.3 Magnetic Force on moving charge
  - 4.3.1 Force on current carrying conductor
  - 4.3.2 Force on rectangular coil placed in magnetic field
- 4.4 Moving coil galvanometer:-principle, construction and working
  - 4.4.1 Conversion of a galvanometer into ammeter and voltmeter

**5. SEMICONDUCTOR AND MODERN PHYSICS**

- 5.1 Energy bands in solids
- 5.2 Types of materials (insulator, semi-conductor, conductor)
- 5.3 p-n junction
  - 5.3.1 Junction diode and V-I characteristics
  - 5.3.2 Types of junction diodes (Zener and Photo Diode)
  - 5.3.3 Diode as rectifier – half wave and full wave rectifier (centre taped)
- 5.4 Lasers:
  - 5.4.1 Energy levels, ionization and excitation potentials
  - 5.4.2 Spontaneous and stimulated emission
  - 5.4.3 Population inversion
  - 5.4.4 Pumping methods
  - 5.4.5 Types of lasers ( Ruby and He-Ne Laser)
  - 5.4.6 Laser characteristics
  - 5.4.7 Engineering and medical applications of lasers
- 5.5 Nanoscience and Nanotechnology:
  - 5.5.1 Introduction only

**REFERENCES:**

1. Text Book of Physics for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi
2. Applied Physics, Vol. I and Vol. II, TTTI Publications, Tata McGraw Hill, Delhi
3. Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi
4. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi.
5. Modern approach to Applied Physics-I and II, AS Vasudeva, Modern Publishers.
6. A Textbook of Optics, N Subramanyam, Brij Lal, MN Avahanulu, S Chand and Company Ltd.

7. Introduction to Fiber Optics, AjoyGhatak and K Thyagarajan, Cambridge University Press India Pvt. Ltd,
8. New Delhi.
9. Nanoscience and Nanotechnology, KK Choudhary, Narosa Publishing House, Pvt. Ltd. New Delhi.
10. Nanotechnology: Importance and Applications, M.H. Fulekar, IK International Publishing House Pvt. Ltd,
11. New Delhi.

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**INTRODUCTION TO IT SYSTEMS**

<b>Course Code</b>	<b>2003</b>
<b>Course Title</b>	<b>Introduction to IT Systems</b>
<b>Number of Credits</b>	<b>3 (L-3,T-0,P-0)</b>
<b>Prerequisites</b>	<b>None</b>
<b>Course Category</b>	<b>Engineering Science</b>

**COURSE OBJECTIVES**

This course is intended to make new students comfortable with computing environment - Learning basic computer skills, Learning basic application software tools, Understanding Computer Hardware, Cyber security awareness.

**COURSE OUTCOMES**

At the end of the course student will be able to comfortably work on computer, install and configure OS, assemble a PC and connect it to external devices, write documents, create worksheets, prepare presentations, protect information and computers from basic abuses/ attacks.

**COURSE CONTENTS****1. BASIC COMPUTER & INTERNET SKILLS**

- 1.1 General understanding of various computer components: Block Diagram of Computer
  - 1.1.1 CPU, Memory, Display, Keyboard, Mouse
  - 1.1.2 HDD and Pen Drive
  - 1.1.3 Peripheral Devices (Printers, Scanners, Web camera & Barcode Reader)
- 1.2 Computer Languages: Machine, Assembly & High-level Language
- 1.3 Computer & Communication: Meaning of Web Address, URL, IP address, E-mail
- 1.4 Awareness about Digital India portals (state and national portals) and college portals.

**2. OPERATING SYSTEMS**

- 2.1 Introduction and Definition Operating Systems
- 2.2 Brief Introduction to Types of Operating Systems
- 2.3 OS Installation:
  - 2.3.1 MS Windows
- 2.4 Brief Introduction to Unix Shell

**3. BASICS OF WEB DEVELOPMENT**

- 3.1 CSS: Introduction
  - 3.1.1 Font Attributes
  - 3.1.2 Colour, Background
- 3.2 Making basic personal webpage

**4. OFFICE TOOLS**

- 4.1 Open Office Writer:
  - 4.1.1 Writer Interface
  - 4.1.2 Starting, Opening, Saving, Closing & Printing a document
  - 4.1.3 Selecting, Cutting, Pasting, Finding & Replacing a text
  - 4.1.4 Formatting Paragraph
  - 4.1.5 Checking Spelling & Autocorrect
- 4.2 Open Office Spreadsheet (Calc):
  - 4.2.1 Spreadsheets, Sheets & Cell
  - 4.2.2 Starting, Opening, Saving, Closing, Printing a Spreadsheet
- 4.3 Open Office Impress:
  - 4.3.1 Adding Animation in Slide
  - 4.3.2 Printing Slide Show

**5. INFORMATION SECURITY BEST PRACTICES**

- 5.1 Desktop & Smartphone security: Password, pattern lock, Two Step authentication (OTP), Biometric Authentication
- 5.2 Computer Viruses: Scanning & Removing

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### 5.3 Guidelines for:

- 5.3.1 Setting up a Secure password
- 5.3.2 Wi-fi security

Class lectures will only introduce the topic or demonstrate the tool, Actual learning will take place in the Lab by practicing regularly

### **SUGGESTED LAB WORK:**

This is a skill course. Topics/concepts taught in the class should be practiced in the Lab same week and practiced regularly during the semester till student becomes confident about it. This course is all about some theory and a lot of practice.

### **REFERENCES:**

1. R.S. Salaria, Computer Fundamentals, Khanna Publishing House
2. Ramesh Bangia, PC Software Made Easy – The PC Course Kit, Khanna Publishing House
3. Online Resources, Linux man pages, Wikipedia
4. Mastering Linux Shell Scripting: A practical guide to Linux command-line, Bash scripting, and Shell programming, by Mokhtar Ebrahim, Andrew Mallett.

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**FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING**

<b>Course Code</b>	<b>2004</b>
<b>Course Title</b>	<b>Fundamentals of Electrical and Electronics Engineering</b>
<b>Number of Credits</b>	<b>4 (L-2,T-2,P-0)</b>
<b>Prerequisites</b>	<b>None</b>
<b>Course Category</b>	<b>Engineering Science</b>

**COURSE OBJECTIVES**

To provide basic knowledge of the different elements and concepts of electrical engineering field and to learn basic concepts of various active and passive electronic components, Signals, Op-Amp and their applications, Digital Electronics and their applications to help students deal with electrical and electronics engineering principles and applications in industrial processes of different fields.

**COURSE CONTENT**

**1. OVERVIEW OF ELECTRONIC COMPONENTS & SIGNALS**

- 1.1 Passive components and their applications
  - 1.1.1 Resistors, type of resistors
  - 1.1.2 Capacitors, type of capacitor
  - 1.1.3 Inductors, type of inductor
- 1.2 Types of waveform
  - 1.2.1 Sinusoidal waveform as alternating Voltage Signal  $v(t) = V_m \sin(\omega t)$
  - 1.2.2 Non Sinusoidal alternating waveforms (triangular, rectangular, square) as voltage signals

**2. OVERVIEW OF BASIC (ANALOG) & DIGITAL ELECTRONICS**

- 2.1 Introduction to Semi-Conductors
  - 2.1.1 Different Semiconductor materials (Si, Ge)
- 2.2 Doping (impurities) in Semiconductors
  - 2.2.1 Intrinsic and Extrinsic Semiconductor
  - 2.2.2 Atomic structure of Intrinsic and Extrinsic Semiconductor
- 2.3 Conductivity
  - 2.3.1 carrier transport: diffusion & drift current, mobility, resistivity
  - 2.3.2 generation and recombination of charge carriers, PN junction
- 2.4 Active components and their application
  - 2.4.1 Diodes, VI Characteristics, forward and reverse bias
  - 2.4.2 Bipolar Junction Transistors (BJT), PNP and NPN BJT, Characteristics.
- 2.5 Boolean Algebra
  - 2.5.1 Logic Gates (NOT, AND, OR, NAND, NOR, EX-OR, EX-NOR)
  - 2.5.2 Binary code of a Decimal Number

**3. ELECTRIC AND MAGNETIC CIRCUITS:**

- 3.1 EMF, Current, Potential Difference, Power and Energy, Ohm's Law, Combination of resistances
- 3.2 M.M.F, magnetic flux
- 3.3 Analogy between electric and magnetic circuits

**4. A.C. CIRCUITS:**

- 4.1 Introduction to AC waveform and terminology
  - 4.1.1 Cycle
  - 4.1.2 Frequency
  - 4.1.3 Time Period
  - 4.1.4 Amplitude
  - 4.1.5 Angular velocity
  - 4.1.6 RMS value
  - 4.1.7 Average value
  - 4.1.8 Form Factor

**5. TRANSFORMERS**

- 5.1 Principal of operation, emf equation, Construction.
- 5.2 Principle of single phase transformer, transformation ratio and step up and step down transformers

**REFERENCES:**

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Publishing House
2. Mittal and Mittal, Basic Electrical Engineering, McGraw Education, New Delhi, 2015, ISBN : 978-0-07-0088572-5
3. Saxena, S. B. Lal, Fundamentals of Electrical Engineering, Cambridge University Press, latest edition ISBN : 9781107464353
4. Theraja, B. L., Electrical Technology Vol – I, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924405
5. Theraja, B. L., Electrical Technology Vol – II, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924375
6. Jegathesan, V., Basic Electrical and Electronics Engineering, Wiley India, New Delhi, 2015, ISBN : 97881236529513
7. Sedha, R.S., A text book of Applied Electronics, S.Chand, New Delhi, 2008, ISBN-13: 978-8121927833
8. Malvino, Albert Paul, David, Electronics Principles, McGraw Hill Education, New Delhi, 2015, ISBN-13: 0070634244-978
9. Mehta, V.K., Mehta, Rohit, Principles of Electronics, S. Chand and Company, New Delhi, 2014, ISBN-13-9788121924504
10. Bell Devid, Fundamental of Electronic Devices and Circuits, Oxford University Press, New Delhi 2015 ISBN : 9780195425239

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**ENGINEERING MECHANICS**

<b>Course Code</b>	<b>2005</b>
<b>Course Title</b>	<b>Engineering Mechanics</b>
<b>Number of Credits</b>	<b>4 (L-3,T-1,P-0)</b>
<b>Prerequisites</b>	<b>None</b>
<b>Course Category</b>	<b>Engineering Science</b>

**COURSE OBJECTIVES**

Following are the objectives of this course:

1. To obtain resultant of various forces
2. To calculate support reactions through conditions of equilibrium for various structures
3. To understand role of friction in equilibrium problems
4. To know fundamental laws of machines and their applications to various engineering problems

**COURSE OUTCOMES**

After completing this course, student will be able to:

1. Identify the force systems for given conditions by applying the basics of mechanics
2. Determine unknown force(s) of different engineering systems.
3. Apply the principles of friction in various conditions for useful purposes.
4. Find the centroid and centre of gravity of various components in engineering systems
5. Select the relevant simple lifting machine(s) for given purposes

**COURSE CONTENTS****1. BASICS OF MECHANICS AND FORCE SYSTEM**

- 1.1 Significance and relevance of Mechanics
  - 1.1.1 Applied mechanics
  - 1.1.2 Statics
  - 1.1.3 Dynamics
- 1.2 Definitions of Space, time, mass, particle, flexible body and rigid body
- 1.3 Scalar and vector quantity ,Units of measurement (SI units)
  - 1.3.1 Fundamental units
  - 1.3.2 Derived units
- 1.4 Force
  - 1.4.1 Unit
  - 1.4.2 Representation as a vector and by Bow's notation
  - 1.4.3 Characteristics and effects of a force
- 1.5 Law of parallelogram

**2. EQUILIBRIUM**

- 2.1 Equilibrium and Equilibrant
  - 2.1.1 Free body and Free body diagram
- 2.2 Lami's Theorem – statement and explanation
  - 2.2.1 Application for various engineering problems
- 2.3 Types of beam
- 2.4 Types of supports (simple, hinged, roller and fixed)
- 2.5 Types of loads acting on beam (vertical and inclined point load, uniformly distributed load, couple)

**3. FRICTION**

- 3.1 Friction and its relevance in engineering
  - 3.1.1 Types and laws of friction
  - 3.1.2 Limiting equilibrium
  - 3.1.3 Limiting friction
  - 3.1.4 Co-efficient of friction
  - 3.1.5 Angle of friction (only theory)
  - 3.1.6 Angle of repose (only theory)
  - 3.1.7 Relation between co-efficient of friction and angle of friction
- 3.2 Equilibrium of bodies on level surface subjected to



- 3.2.1 Force parallel to plane
- 3.2.2 Force inclined to plane

#### 4. CENTROID AND CENTRE OF GRAVITY

- 4.1 Center of gravity of : Square , Rectangle, Triangle, Circle, Semi-circle and Quarter circle(No derivation)
- 4.2 Centroid of composite figures composed of not more than three geometrical figures
- 4.3 Centre of Gravity of Cube, Cuboid, Cone, Cylinder, Sphere and hemisphere (No derivation)

#### 5. SIMPLE LIFTING MACHINE

- 5.1 Simple lifting machine
  - 5.1.1 Related terms: load, effort, mechanical advantage
  - 5.1.2 Applications and advantages.
  - 5.1.3 Velocity ratio
  - 5.1.4 Efficiency of machines
- 5.2 Law of machine
- 5.3 Ideal machine
  - 5.3.1 Friction in machine
  - 5.3.2 Maximum Mechanical advantage and efficiency

#### REFERENCES:

- |  |                |
|--|----------------|
| 1. Engineering Statics (in Hindi )                                       | Gokhru&Soni    |
| 2. Applied Mechanics (in Hindi)  | A. R. Paage    |
| 3. Engineering Mechanics   | D. S. Kumar    |
| 4. Applied Mechanics S. Chand & Co. New Delhi.                           | R.S. Khurmi    |
| 5. Engineering Mechanics   | A. R. Basu     |
| 6. Engineering Mechanics, Khanna Publications, New Delhi (2008)          | D.S. Bedi,     |
| 7. A text book of Engineering Mechanics Laxmi Publications.              | Bansal R K     |
| 8. Engineering Mechanics S. Chand & Co. New Delhi.                       | Ramamrutham    |
| 9. Fundamental of Applied Mechanics Pune Vidhyarthi Gruh.<br>&Walawelkar | Dhade, Jamadar |

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**APPLIED PHYSICS II LAB**

<b>Course Code</b>	<b>2006</b>
<b>Course Title</b>	<b>Applied Physics II Lab</b>
<b>Number of Credits</b>	<b>1 (L-0,T-0,P-2)</b>
<b>Prerequisites</b>	<b>None</b>
<b>Course Category</b>	<b>Basic Science</b>

**COURSE OBJECTIVES**

Concrete use of physical principles and analysis in various fields of engineering and technology is very prominence. The course aims to supplement the factual knowledge gained in the lecture by first hand manipulation of apparatus. This will develop scientific temper and help to apply the basic concepts and principles in solving engineering and technology based problems. In addition, students get necessary confidence in handling equipment and thus learn various skills in measurement.

**COURSE OUTCOMES**

After undergoing this subject, the student will be able to;

1. Apply concept of SHM to find out the gravitational acceleration
2. Verify optical laws; reflection, refraction from plane interfaces and surfaces.
3. Apply knowledge of optics to determine focal length and magnifying power of optical lenses.
4. Understand uses of electrical components and meters and verify Ohm's law for flow of current.
5. Quantify resistances and verify laws of series and parallel combination of resistances.
6. Analyse electrical circuits and verify Kirchhoff's law governing electrical circuits.
7. Measure resistance of a galvanometer and how it is converted into an ammeter and voltmeter.
8. Investigate characteristics of semiconductor diodes, photoelectric cells and determine operational parameters associated with their performance.
9. Work with laboratory lasers and understand method to measure the wavelength of the light emitted from a laser.
10. How to handle optical fibers.

**LIST OF PRACTICALS/ACTIVITIES: (To perform minimum 10 Practicals)**

1. To determine acceleration due to gravity using simple pendulum.
2. To verify laws of reflection from a plane mirror/ interface.
3. To verify laws of refraction (Snell's law) using a glass slab.
4. To determine focal length and magnifying power of a convex lens.
5. To verify Ohm's law by plotting graph between current and potential difference.
6. To verify laws of resistances in series and parallel combination.
7. To determine specific resistance of material using meter bridge.
8. To determine internal resistance of a primary cell using potentiometer.
9. To compare EMF of two primary cells using potentiometer.
10. To find resistance of a galvanometer by half deflection method.
11. To convert a galvanometer into an ammeter.
12. To convert a galvanometer into a voltmeter.
13. To draw V-I characteristics of a semiconductor diode (Ge, Si) and determine its knee voltage.

**SUGGESTED STUDENT ACTIVITIES & STRATEGIES**

Apart from classroom and laboratory learning following are the suggested student related activities which can be undertaken to accelerate the attainment of various outcomes of the course.

1. Survey of different physical products and compare the following points
  - 1.1 Measurements of dimensions
  - 1.2 Properties
  - 1.3 Applications
2. Library survey regarding engineering materials/products used in different industries
3. Seminar on any relevant topic. Teachers should use the following strategies to achieve the various outcomes of the course
4. Different methods of teaching and media to be used to attain classroom attention.
5. Massive open online courses (MOOCs) may be used to teach various topics/sub topics.

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6. 15-20% of the topics which are relatively simpler or descriptive in nature should be given to the students for self-learning and assess the development of competency through classroom presentations/projects.
7. Micro-projects on relevant may be given to group of students for hand-on experiences.

**RECOMMENDED BOOKS:**

1. Text Book of Physics for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi
2. Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publications (P) Ltd., New Delhi
3. Practical Physics by C. L. Arora, S. Chand & Company Ltd.
4. e-books/e-tools/ learning physics software/you Tube videos/ websites etc.

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**INTRODUCTION TO IT SYSTEMS LAB**

<b>Course Code</b>	<b>2007</b>
<b>Course Title</b>	<b>Introduction to IT Systems</b>
<b>Number of Credits</b>	<b>2 (L-0,T-0,P-4)</b>
<b>Prerequisites</b>	<b>None</b>
<b>Course Category</b>	<b>Engineering Science</b>

**COURSE OBJECTIVES**

This Lab course is intended to practice whatever is taught in theory class of 'Introduction of IT Systems' and become proficient in using computing environment - basic computer skills, basic application software tools, Computer Hardware, cyber security features, etc.

**COURSE OUTCOMES**

At the end of the course student will be able to comfortably work on computer, install and configure OS, assemble a PC and connect it to external devices, write documents, create worksheets, prepare presentations, protect information and computers from basic abuses/attacks.

**COUSRE CONTENT**

<b>S.No.</b>	<b>Topics for Practice</b>
<b>1</b>	Read Wikipedia pages on computer hardware components, look at those components in lab, identify them, recognise various ports/interfaces and related cables, etc.
<b>2</b>	Connect various peripherals (printer, scanner, etc.) to computer, explore various features of peripheral and their device driver software.
<b>3</b>	Browser features, browsing, using various search engines, writing search queries.
<b>4</b>	Visit various e-governance/Digital India portals, understand their features and services offered.
<b>5</b>	Install Windows operating system on lab machine and explore various options.
<b>6</b>	Install Linux operating system on lab machine and explore various options.
<b>7</b>	Practice various HTML tags.
<b>8</b>	Make your own Webpage using HTML tags.
<b>9</b>	Explore features of Open Office Writer and practice to create documents.
<b>10</b>	Explore features of Open Office Calc and practice to create spreadsheets.
<b>11</b>	Explore features of Open Office Impress and practice to create presentations.
<b>12</b>	Explore security features of Operating Systems and Tools.
<b>13</b>	Demonstration of various digital payment methods (Net Banking, Digital Wallet, UPI etc.)

This is a skill course. More you practice, better it will be.

**REFERENCES:**

1. Online resources, Linux man pages, Wikipedia.
2. R.S. Salaria, Computer Fundamentals, Khanna Publishing House.
3. Ramesh Bangia, PC Software Made Easy – The PC Course Kit, Khanna Publishing House.
4. Mastering Linux Shell Scripting: A practical guide to Linux command-line, Bash scripting, and Shell programming, by Mokhtar Ebrahim, Andrew Mallett.
5. IT Essentials PC Hardware and Software Companion Guide, Davis Anfinson and Ken Quamme, CISC Press, Pearson Education.
6. PC Hardware and A+ Handbook, Kate J. Chase PHI (Microsoft)

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### FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING LAB

<b>Course Code</b>	<b>2008</b>
<b>Course Title</b>	<b>Fundamentals of Electrical and Electronics Engineering Lab</b>
<b>Number of Credits</b>	<b>2 (L-0,T-0,P-4)</b>
<b>Prerequisites</b>	<b>None</b>
<b>Course Category</b>	<b>Engineering Science</b>

#### COURSE OBJECTIVES

##### Suggested Practicals/Exercises:

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

#### COURSE OUTCOMES

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

1. Understand basic principle and operation of electric circuits and machines.
2. Solve basic problems related to electrical circuits and machines. Explain the operation of different electrical technologies.
3. Demonstrate an understanding of the control systems.
4. Understand the basic circuit elements
5. Understand different types of signal waveforms.
6. Understand logic gates and apply them in various electronic circuits.
7. Understand the basic concepts of op-amps, and their applications.
8. Use relevant electric/electronic protective devices safely.

S. No.	Practical Outcomes (PrOs)	Approx. Hrs.
1.	Study of Symbol, Specification of Common Electrical Accessories, Tools and Wires & Cables.	02
2.	(A) Electric safety precaution and use of fire fighting equipment (B) Study of basic Electricity Rules for a Domestic Consumer.	02
3.	Use of Phase Tester, Series Test Lamp, Tong Tester and Megger in Testing of Electrical Installation	02
4.	Measurement of current, voltage, power and energy in AC and DC circuits.	02
5.	Preparation of Wiring Diagram, Wiring, Testing, Fault Finding & Costing for : 5.1 Control of one LED Lamp by one Switch (using casing capping & Flush type switch) 5.2 Control of Stair Case Wiring 5.3 Control of one Bell Buzzer and Indicator by one switch	02
6.	Prepare one Switch Board as per requirement ( using Flush type Switches, Sockets, Ceiling rose, Lamp holder, MCB, Etc.)	02
7.	Study, Connecting, Testing and Fault Finding of Fluorescent Tube and its Accessories	02
8.	Study, Connecting, Testing and Fault Finding of Ceiling Fan with Electronic Regulator	02
9.	Connect single phase transformer. Measure input and output quantities determine its transformation ratio.	02
10.	Prepare a Potential Divider and Measure Resistance of a Filament Lamp Using Voltmeter and Ammeter.	02
11.	Study and functioning of automatic electric iron.	02
12.	Study and functioning of electric water pump and air cooler.	02
13.	Sketching of different Electronic Components Symbol on Drawing Sheet.	02
14.	Identify various passive electronic components in the given circuit 9.1 Resistors-Fixed Resistors and Variable Resistors 9.2 Capacitors- Electrolytic Capacitors and Ceramic Capacitors 9.3 Inductors	02
15.	Soldering of different passive component combination on general purpose PCB.	02
16.	Testing of the following electronic components using digital multimeter. 10.1 Resistor 10.2 PN Junction Diode 10.3 Bipolar Junction Transistor	02

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<b>17.</b>	Study of devices used in electronic workshop. 11.1 Function Generator 11.2 CRO 11.3 LCR Meter	<b>02</b>
<b>18.</b>	Use of LCR meter to measure the value of given Capacitor and Inductor.	<b>02</b>
<b>19.</b>	Measurement of amplitude and frequency of a sinusoidal signal using CRO.	<b>02</b>
<b>20.</b>	Measurement of amplitude and frequency of a Non-sinusoidal signal using CRO.	<b>02</b>
<b>21.</b>	Test the performance of PN Junction Diode and Zener Diode	<b>02</b>
<b>22.</b>	Test the performance of Transistor Amplifier Circuit.	<b>02</b>
<b>23.</b>	Verify the truth tables of different logic gates	<b>02</b>
<b>24.</b>	Verification of Ohm's law using Resistive Circuit and Analog/ Digital Meters	<b>02</b>

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**ENGINEERING MECHANICS LAB.**

<b>Course Code</b>	<b>2009</b>
<b>Course Title</b>	<b>Engineering Mechanics Lab</b>
<b>Number of Credits</b>	<b>1 (L-0,T-0,P-2)</b>
<b>Prerequisites</b>	<b>None</b>
<b>Course Category</b>	<b>Engineering Science</b>

**COURSE OBJECTIVES**

Following are the objectives of this course:

1. To obtain resultant of various forces
2. To calculate support reactions through conditions of equilibrium for various structures
3. To understand role of friction in equilibrium problems
4. To know fundamental laws of machines and their applications to various engineering problems

**COURSE OUTCOMES**

After completing this course, student will be able to

1. Identify the force systems for given conditions by applying the basics of mechanics.
2. Determine unknown force(s) of different engineering systems.
3. Apply the principles of friction in various conditions for useful purposes.
4. Find the centroid and centre of gravity of various components in engineering systems.
5. Select the relevant simple lifting machine(s) for given purposes.

**LIST OF PRACTICAL TO BE PERFORMED**

1. Verification of the Law of Parallelogram and Polygon of Forces
  - 1.1 By using Force Board
  - 1.2 By using Force Table
2. Determination of Reactions in Case of Simply Supported Beams.
3. To Determine Coefficient of Friction between two Surfaces on
  - 3.1 Horizontal Plane
  - 3.2 Inclined Plane.
4. Determination of Mechanical Advantage, Velocity Ratio and Efficiency of Simple Wheel and Axle
5. Determination of Mechanical Advantage, Velocity Ratio and Efficiency of differential Wheel and Axle
6. Determination of Mechanical Advantage, Velocity Ratio and Efficiency of Single Purchase Crab
7. Determination of Mechanical Advantage, Velocity Ratio and Efficiency of Double Purchase Crab
8. Determination of Mechanical Advantage, Velocity Ratio and Efficiency of Worm and Worm Wheel
9. Determination of Mechanical Advantage, Velocity Ratio and Efficiency of Screw Jack
10. Determination of Mechanical Advantage, Velocity Ratio and Efficiency of First System of Pulleys
11. Determination of Mechanical Advantage, Velocity Ratio and Efficiency of Second System of Pulleys

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**ENVIRONMENTAL SCIENCE**

Course Code	2010
Course Title	ENVIRONMENTAL SCIENCE
Number of Credits	2 (L-2,T-0,P-0)
Prerequisites	None
Course Category	Basic Science

**COURSE OBJECTIVES**

Technicians working in industries or elsewhere essentially require the knowledge of environmental science so as to enable them to work and produce most efficient, economical and eco-friendly finished products.

1. Solve various engineering problems applying ecosystem to produce eco – friendly products.
2. Use relevant air and noise control method to solve domestic and industrial problems.
3. Use relevant water and soil control method to solve domestic and industrial problems.
4. To recognize relevant energy sources required for domestic and industrial applications.
5. Solve local solid and e-waste problems.

**COURSE OUTCOMES**

At the end of the course student will be able to

1. Understand the ecosystem and terminology and solve various engineering problems applying ecosystem knowledge to produce eco – friendly products.
2. Understand the suitable air, extent of noise pollution, and control measures and acts.
3. Understand the water and soil pollution, and control measures and acts.
4. Understand different renewable energy resources and efficient process of harvesting.
5. Understand solid Waste Management, ISO 14000 & Environmental Management.

**COURSE CONTENT****1. ECOSYSTEM**

- 1.1 Structure of ecosystem
  - 1.1.1 Biotic & Abiotic components
- 1.2 Food chain and food web
- 1.3 Global warming
  - 1.3.1 Causes
  - 1.3.2 Effects
  - 1.3.3 Process
  - 1.3.4 Green House Effect
  - 1.3.5 Ozone depletion

**2. AIR AND NOISE POLLUTION**

- 2.1 Definition of pollution and pollutant
- 2.2 Natural and manmade sources of air pollution (Refrigerants, A.C., Boiler)
- 2.3 Air Pollutants:
  - 2.3.1 Types
  - 2.3.2 Particulate Pollutants: Effects and control (Bag filter, Cyclone separator, Electrostatic Precipitator)
- 2.4 Noise pollution:
  - 2.4.1 sources of pollution
  - 2.4.2 measurement of pollution level
  - 2.4.3 Effects of Noise pollution

**3. WATER AND SOIL POLLUTION**

- 3.1 Water pollution
  - 3.1.1 Sources of water pollution
  - 3.1.2 Types of water pollutants
  - 3.1.3 Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids
- 3.2 Waste Water Treatment:
  - 3.2.1 Primary methods: sedimentation, froth floatation



- 3.2.2 Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor
- 3.2.3 Tertiary Method: Membrane separation technology, RO (reverse osmosis)
- 3.3 3.4 Soil pollution:
  - 3.3.1 Causes
  - 3.3.2 Effects
  - 3.3.3 Preventive measures of Soil Pollution

#### **4. RENEWABLE SOURCES OF ENERGY**

- 4.1 Solar Energy:
  - 4.1.1 Basics of solar energy
- 4.2 Applications
  - 4.2.1 Solar pond
  - 4.2.2 Solar water heater
  - 4.2.3 Solar dryer
- 4.3 Biomass:
  - 4.3.1 Overview of biomass as energy source
  - 4.3.2 Thermal characteristics of biomass as fuel
  - 4.3.3 Anaerobic digestion
  - 4.3.4 Utilization and storage of biogas
- 4.4 Wind energy:
  - 4.4.1 Current status and future prospects of wind energy
  - 4.4.2 Wind energy in India
- 4.5 Applications of
  - 4.5.1 Hydrogen energy
  - 4.5.2 Ocean energy resources

#### **5. 5. SOLID WASTE MANAGEMENT ISO 14000 & ENVIRONMENTAL MANAGEMENT**

- 5.1 Solid waste generation
- 5.2 Sources and characteristics of
  - 5.2.1 Municipal solid waste
  - 5.2.2 E- waste
  - 5.2.3 Biomedical waste
- 5.3 Collection and disposal:
  - 5.3.1 MSW (3R, principles, energy recovery, sanitary landfill),
  - 5.3.2 Hazardous waste
- 5.4 Different environmental acts
  - 5.4.1 Air quality act 2004
  - 5.4.2 Air pollution control act 1981
  - 5.4.3 Water pollution and control act 1996

#### **REFERENCES:**

1. S.C. Sharma & M.P. Poonia, Environmental Studies, Khanna Publishing House, New Delhi
2. C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.
3. Arceivala, Soli Asolekar, Shyam, Waste Water Treatment for Pollution Control and Reuse, Mc-Graw Hill Education India Pvt. Ltd., New York, 2007, ISBN:978-07-062099-
5. Nazaroff, William, Cohen, Lisa, Environmental Engineering Science, Wiley, New York, 2000, ISBN 10: 0471144940.
6. O.P. Gupta, Elements of Environmental Pollution Control, Khanna Publishing House, New Delhi
7. Rao, C. S., Environmental Pollution Control and Engineering, New Age International Publication, 2007, ISBN: 81-224-1835-X.
8. Rao, M. N. Rao, H.V.N, Air Pollution, Tata Mc-Graw Hill Publication, New delhi, 1988, ISBN: 0-07-451871-8.
9. Frank Kreith, Jan F Kreider, Principles of Solar Engineering, McGraw-Hill, New York ; 1978, ISBN: 9780070354760.
10. Aldo Vieira, Da Rosa, Fundamentals of renewable energy processes, Academic Press Oxford, UK; 2013. ISBN: 9780123978257.
11. Patvardhan, A.D, Industrial Solid Waste, Teri Press, New Delhi, 2013, ISBN:978-81-7993-502-6
12. Metcalf & Eddy, Waste Water Engineering, Mc-Graw Hill, New York, 2013, ISBN: 077441206.

13. Keshav Kant, Air Pollution & Control, Khanna Publishing House, New Delhi (Edition 2018)

**Open source software and website address:**

1. [www.eco-prayer.org](http://www.eco-prayer.org)
2. [www.teriin.org](http://www.teriin.org)
3. [www.cpcp.nic.in](http://www.cpcp.nic.in)
4. [www.cpcp.gov.in](http://www.cpcp.gov.in)
5. [www.indiaenvironmentportal.org.in](http://www.indiaenvironmentportal.org.in)
6. [www.whatis.techtarget.com](http://www.whatis.techtarget.com)
7. [www.sustainabledevelopment.un.org](http://www.sustainabledevelopment.un.org)
8. [www.conserve-energy-future.com](http://www.conserve-energy-future.com)

Teachers should use the following strategies to achieve the various outcomes of the course.

1. Different methods of teaching and media to be used to attain classroom attention.
2. Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
3. 15-20% of the topics which are relatively simpler of descriptive in nature should be given to the students for self-learning and assess the development of competency through classroom presentations.
4. Micro-projects may be given to group of students for hand-on experiences
5. Encouraging students to visit to sites such as Railway station and research establishment around the institution.

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