

**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<br>Vikas Publishing House. | V. Sundaram, R. Balasubramanian, K.A. Lakshminarayanan, , 6/e.,        |
| 11. Advanced Engineering Mathematics<br>Delhi          | Reena Garg & Chandrika Prasad, , Khanna Publishing House, New<br>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. 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, Pavan Muktasana.
- 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 Asthema: 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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