

First Year
Curriculum Structure
(Common to All Branches)
2020-21

Semester I

(Common to All Branches)

Sl. No	Category Of Courses	Code No.	Course Title	Hours per week			Total contact hrs/week	Credits
				L	T	P		
1	Basic Science-1	BS101	Mathematics- I	2	1	0	3	3
2	Basic Science-2	BS102	Applied Physics- I	2	1	0	3	3
3	Basic Science-3	BS103	Applied Chemistry	2	1	0	3	3
4	Humanities & Social Science-1	HS104	Communication Skills in English	2	0	0	2	2
5	Engineering Science-1	ES105	Engineering Graphics	0	0	3	3	1.5
6	Engineering Science-2	ES 106	Engineering Workshop Practice	0	0	3	3	1.5
7	Basic Science-4	ES 107	Applied Physics- I Lab	0	0	2	2	1
8	Basic Science-5	BS108	Applied Chemistry Lab	0	0	2	2	1
9	Humanities & Social Science-2	HS109	Sports & Yoga	0	0	2	2	1
10	Humanities & Social Science-3	HS110	Communication Skills in English Lab	0	0	2	2	1
Total Credits								18

Semester II

(Common to All Branches)

Sl. No	Category Of Courses	Code No.	Course Title	Hours per week			Total contact hrs/week	Credits
				L	T	P		
1	Basic Science-6	BS201	Mathematics- II	3	1	0	4	4
2	Basic Science-7	BS202	Applied Physics- II	2	1	0	3	3
3	Engineering Science-3	ES203	Introduction to IT Systems	2	0	0	2	2
4	Engineering Science-4	ES204	Fundamentals of Electrical & Electronics Engineering	2	1	0	3	3
5	Engineering Science-5	ES205	Engineering Mechanics	2	1	0	3	3
6	Basic Science-8	BS206	Applied Physics- II Lab	0	0	2	2	1
7	Engineering Science-6	ES207	Introduction to IT Systems Lab	0	0	4	4	2
8	Engineering Science-7	ES208	Fundamentals of Electrical & Electronics Engineering Lab	0	0	2	2	1
9	Engineering Science-8	ES209	Engineering Mechanics Lab	0	0	2	2	1
10	Audit-1	AU210	Environmental Science	2	0	0	2	0
Total Credits								20

Detailed First Year Curriculum Contents

(Semester I)

Mathematics I

Course Code	BS – 101
Course Title	Mathematics – I
Number of Credits	3 (L : 2, T : 1, P : 0)
Prerequisites	High School Level Mathematics
Course Category	Basic Science (BS)

Course Outcomes: By the end of the course, the students are expected to

C.O.1: Categorize the necessary background in Trigonometry to appreciate the importance of the geometric study as well as for the calculation and the mathematical analysis.(K4)

C.O.2: Identify the location of a complex number in Argand plane and carryout algebraic operations on complex numbers.(K4)

C.O.3: Determine values of large numbers having integral or non-integral powers.(K3)

C.O.4: Investigate the behavior of different types of functions.(K4)

C.O.5: Apply derivatives of different types of functions to solve problems.(K3)

Detailed Course Contents

Module – 1: Trigonometry

Number of Class hours: 10

Learning Outcomes:

1. Illustrate the concepts of Angle, distance, height with reference to different shapes, objects etc.(K3)
2. Uses of inverse trigonometric functions to calculate angles and inclinations under different situations.(K3)
3. Identify the relation between different trigonometric functions.(K4)

Detailed content of the unit:

- 1.1 Concept of angles, measurement of angles in degrees, grades and radians and their conversions.
- 1.2 Compound Angles and Associated Angles.
- 1.3 Transformation of sum or difference into products and products and products into sum or differences.
- 1.4 Multiple and Sub-multiple Angles.
- 1.5 Solution of Trigonometric equations (angles between 0 and 2π).
- 1.6 Inverse Circular Functions. Applications & simple problems.

Module – 2: Complex Number

Number of Class hours: 8

Learning Outcomes:

1. Recognize and define Cartesian and Polar form of complex number.(K4)
2. Identify the location of a complex number in Argand plane.(K4)
3. Use algebraic operations on complex numbers.(K3)

Detailed content of the unit:

- 2.1 Complex Numbers.
- 2.2 Conjugate complex number.
- 2.3 Geometric representation of a complex number.
- 2.4 Modulus and amplitude of a complex number – simple problems.
- 2.5 Polar form of a complex number – simple problems.
- 2.6 Rationalisation, addition and multiplication of complex numbers – simple problems.
- 2.7 Square root of a complex number – simple problems.
- 2.8 Cube root of unity – simple problems.
- 2.9 D’Moivre’s Theorem – simple problems.

Module – 3: Binomial Theorem.

Number of Class hours: 8

Learning Outcomes:

1. Explain the Permutation and Combination of elements (similar and unique). (K4)
2. Identify and expand different types of binomial expressions.(k4)
3. Use Binomial Theorem to get values of large numbers having integral and rational powers.(K3)

Detailed content of the unit:

- 3.1 Permutations and Combinations: Factorial notation and basic principle of counting, definition and meaning of ${}^n P_r$ and ${}^n C_r$ – simple problems.
- 3.2 Binomial Theorem for positive integral index, general term, middle terms, co-efficient of x^n , terms independent of x^n , binomial theorem for any index (expansion without proof) first and second binomial approximation with application to engineering problems.

Module – 4: Function, Limit and Continuity.

Number of Class hours: 8

Learning Outcomes:

1. Identify different types of functions and their Domain and Range.(K4)
2. Solve limiting value of a function under different conditions.(K3)
3. Investigate the behavior of continuous and discontinuous functions.(K4)

Detailed content of the unit:

- 4.1 Function: Definition, types of functions, odd and even functions, periodic, composite, explicit, implicit and parametric functions. Increasing and Decreasing functions, Domain and Range of a function – simple problems.
- 4.2 Limit of a function: Definition, Standard limits, Left hand and Right hand limits, Evolution of limits – simple problems.
- 4.3 Continuity of a function: Definition, continuity of a real function at a point, testing of continuity – simple problems.

Module – 5: Differentiation

Number of Class hours: 12

Learning Outcomes:

1. Explain the meaning of differentiation.(K4)
2. Apply derivatives of different types of functions to solve problems.(K3)
3. Use 2nd order derivative to solve problems.(K3)

Detailed content of the unit:

- 5.1 Differential Coefficient.
- 5.2 Differentiation of some standard functions from first principles.
(x^n , $\sin x$, $\cos x$, $\tan x$, e^x and $\log_a x$).
- 5.3 Differentiation of sum, product and quotient of function.
- 5.4 Differentiation of trigonometric and inverse trigonometric functions, Logarithmic functions, Exponential functions – simple problems.
- 5.5 Derivative of function of a function, implicit functions, parametric function. Logarithmic differentiation – simple problems.
- 5.6 Successive differentiation upto 2nd order – simple problems.
- 5.7 Physical meaning of derivative – Velocity and Acceleration – Maxima & Minima.

References:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 40th Edition, 2007.
2. H.K.Dass, Advance Engineering Mathematics, S.Chand & Company Ltd, New Delhi.
3. Reena Garg, Engineering Mathematics, Khanna Publishing House, New Delhi (Revised Ed. 2018).
4. V.Sundaram, R.Balasubramanian, K.A.Lakshminarayanan, Engineering Mathematics, 6/e, Vikas Publishing House.

Applied Physics- I

Course Code	BS102
Course Title	Applied Physics-I
Number of Credits	3 (L: 2, T: 1, P: 0)
Prerequisites	High School Physics
Course Category	Basic Science (BS)

Course Outcome:-

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

C.O.1: Identify different systems of units and compare physical quantities with accuracy. (K4)

C.O.2: Compare among linear, angular and rotational motion. (K4)

C.O.3: Explain the methods for reduction of friction to find solution to engineering problems. (K4)

C.O.4: Apply the concept of elasticity, surface tension and viscosity to solution to engineering problems. (K3)

C.O.5: Apply the knowledge of good and bad conductors of heat needed for different engineering tasks. (K3)

Course Content:-

Module- 1: Physical world, Units and Measurements

Number of class hours: 4 to 5

Learning Outcomes:-

Students will be able to

- * Identify physical quantities; select their units for use in engineering solutions. (K4)
- * Apply the method of dimensions to derive physical equation. (K3)
- * Discuss the advantages and limitations of dimensional equations. (K2)
- * Compare & measure different physical quantities with accuracy by minimizing different types of errors. (K4)

Content:-

Physical quantities; fundamental and derived, Units and systems of units (FPS, CGS and SI units),

Dimensions and dimensional formulae of physical quantities, Principle of homogeneity of dimensions, Dimensional equations and their applications (conversion from one system of units to other, checking of dimensional equations and derivation of simple equations), Limitations of dimensional analysis.

Measurements: Need, measuring instruments, least count, types of measurement (direct, indirect), Errors in measurements (systematic and random), absolute error, relative error, error propagation, error estimation and significant figures.

Module- 2: Force and Motion

Number of class hours: 6 to 7

Learning Outcomes:-

Students will be able to

- Describe force, linear momentum, angular displacement, angular acceleration, angular momentum, torque, frequency, and time period. (K1)
- Compare and relate physical properties associated with linear motion and rotational motion. (K4)
- Apply conservation of angular momentum principle to known problems. (K3)

Content:-

Force, Resolution of forces, Momentum, Statement and derivation of conservation of linear momentum, its applications such as recoil of gun, rockets, Impulse and its applications.

Circular motion, definition of angular displacement, angular velocity, angular acceleration, frequency, time period, Relation between linear and angular velocity, linear acceleration and angular acceleration (related numerical), Centripetal and Centrifugal forces with live examples, Expression and applications such as banking of roads and bending of cyclist.

Translational and rotational motions with examples, Definition of torque and angular momentum and their examples, Conservation of angular momentum (quantitative) and its applications.

Module- 3: Work, Power and Energy

Number of class hours: 7 to 8

Learning Outcomes:-

Students will be able to

- Define work, power, energy and their units. (K1)
- Use the relationships amongst work, power and energy to apply in engineering solutions. (K3)
- Identify various forms of energy, energy transformation and state the principle of conservation of energy. (K4)
- Explain the forms of friction and methods to minimize friction between different surfaces. (K2)

Content:-

Work: Concept and units, examples of zero work, positive work and negative work

Friction: concept, types, laws of limiting friction, coefficient of friction, reducing friction and its engineering applications, Work done in moving an object on horizontal and inclined plane for rough and plane surfaces and related applications.

Energy and its units, kinetic energy, gravitational potential energy with examples and derivations, mechanical energy, conservation of mechanical energy for freely falling bodies, transformation of energy (examples).

Power and its units, power and work relationship, calculation of power (numerical problems).

Module- 4: Properties of Matter

Number of class hours: 10-12

Learning Outcomes:-

Students will be able to

- Define stress, strain, moduli of elasticity, atmospheric pressure, absolute pressure, gauge pressure. (K1)
- Explain the phenomenon of surface tension, viscosity of fluid, co-efficient of viscosity, factors affecting surface tension and viscosity. (K2)
- State Hooke's law, Stoke's law. (K1)
- Solve engineering problems applying the concept of elasticity, surface tension and viscosity. (K3)

Content:-

Elasticity: definition of stress and strain, moduli of elasticity, Hooke's law, significance of stress-strain curve.

Pressure: definition, units, atmospheric pressure, gauge pressure, absolute pressure, Fortin's Barometer and its applications.

Surface tension: concept, units, cohesive and adhesive forces, angle of contact, Ascent Formula (No derivation), applications of surface tension, effect of temperature and impurity on surface tension.

Viscosity and coefficient of viscosity: Terminal velocity, Stoke's law and effect of temperature on viscosity, application in hydraulic systems.

Hydrodynamics: Fluid motion, stream line and turbulent flow, Reynold's number Equation of continuity, Bernoulli's Theorem (only formula and numerical) and its applications.

Module- 5: Heat and Thermometry

Number of class hours: 7-8

Learning Outcomes:-

Students will be able to

- Discuss the concepts of heat and temperature, measure temperature in various processes on different scales (Celsius, Fahrenheit and Kelvin etc). (K2)
- Illustrate the processes of conduction, convection and radiation. (K3)

Content:-

Concept of heat and temperature, modes of heat transfer (conduction, convection and radiation with examples), specific heats, scales of temperature and their relationship, Types of Thermometer (Mercury thermometer, Bimetallic thermometer, Platinum resistance thermometer, Pyrometer) and their uses.

Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions and relation amongst them, Co-efficient of thermal conductivity, engineering applications.

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 Bhhatacharya & 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.

Applied Chemistry

Course Code	BS 103
Course Title	Applied Chemistry
Number of Credit	3 (L: 2, T: 1, P: 0)
Prerequisites	High School Level Chemistry
Course Category	BS

Course Outcome:

After completion of the course, students will be able to

C.O.1: Discuss the fundamentals of Atomic Structure and Chemical Bonding. **K₂**

C.O.2: Illustrate the fundamentals of Oxidation, Reduction and Solution and relate the laws of Electrolysis in the Industrial field. **K₃**

C.O.3: Illustrate various water sample and discuss set up for removal of Hardness of water. **K₃**

C.O.4: Discuss the fundamentals of fuel and lubricant and identify the selection of lubricant for different types of machine. **K₂**

C.O.5: Use the properties of various Engineering Materials – Metals (Iron, Aluminium and Copper), Portland cement, glass, brick, polymer in real life situation. **K₃**

Course Content:

Module – 1 : Atomic Structure and Chemical Bonding
Number of Class hours : 8 hours

Learning Outcome : Students will be able to

- ✓ Explain the structure of atom using Rutherford and Bohr's atomic model. **K₂**
- ✓ Define and classify quantum number based upon atomic structure, **K₁**
- ✓ Understand significance of quantum numbers. **K₂**
- ✓ Discuss the shapes of various orbitals (s-p-d). **K₂**
- ✓ Describe various rules and principles (Hund's Rule, Pauli's Exclusion Principle Heisenberg Uncertainty Principle). **K₁**
- ✓ Describe Electronic configuration (z=1-30). **K₁**
- ✓ Describe various types of bonding, their characteristics and formation of each type using suitable examples (NaCl, H₂, F₂, HF and NH₄⁺). **K₁**

- ✓ Understand the concept of hybridization(sp, sp², sp³) **K₂**
- ✓ Discuss shape and find bond angles of various molecules using VSEPR theory(BeCl₂, BF₃, CH₄, NH₃, H₂O). **K₂**
- ✓ Describe types of Hydrogen Bonding in NH₃ and H₂O. **K₂**

Detailed content of the Unit :

RUTHERFORDS ATOMIC MODEL- Postulates and Defects. BOHRS ATOMIC MODEL – Postulates and Defect, Heisenberg Uncertainty Principle, Quantum Numbers-Orbital Concept, Shapes of s, p and d orbitals. Aufbau Principle, Hund's Rule, Pauli's Exclusion Principle, Electronic Configuration. Concept of Chemical Bonding, Characteristics of Electrovalency, Covalency. Types of bonds: Ionic bonding (NaCl example), Covalent bonding (H₂, F₂, HF), Coordinate bonding(NH₄⁺ Concept of Hybridisation SP³, SP² and SP and shape of molecules by VSEPR Theory (BeCl₂, BF₃, CH₄, NH₃), Hydrogen Bonding(NH₃ and H₂O)

Module – 2 : Solution, Oxidation and Reduction and Electro Chemistry

Number of Class hours: 8 hours

Learning Outcomes: Students will be able to

- ✓ Explain terms related to solutions. **K₂**
- ✓ Discuss standard solutions. **K₂**
- ✓ Illustrate the units of various concentration terms. **K₃**
- ✓ Explain the fundamentals of oxidation and reduction. **K₂**
- ✓ Discuss half cell reaction (oxidation half cell and reduction half cell) and balance chemical equation by Ion Electron Method. **K₂**
- ✓ Discuss Faraday's Laws of Electrolysis. **K₂**
- ✓ Apply Faraday's Laws of Electrolysis in solving numerical problems. **K₃**
- ✓ Use Laws of electrolysis in industry. For example electroplating, electrotyping, etc. **K₃**
- ✓ Discuss various Electrolytic cell. **K₂**
- ✓ Discuss and classify Corrosion (chemical and electro chemical). **K₂**

Detailed content of the Unit:

Concept of Solute, Solvent and Solution. Standard Solution, Normal Solution, Molar Solution. Concentration terms: Normality, Molarity, Mole Fraction. Electronic concept of Oxidation, Reduction and Redox reaction. Half cell reaction (oxidation and reduction), Faraday's Laws of Electrolysis (First and Second Law), Problems. Industrial application – Electroplating, Electrotyping, Galvanization. Electrolytic Cell, Electro Chemical Cell, Primary Cell - Dry Cell, Secondary Cell – Lead Storage Cell, Introduction to Corrosion of Metals – definition, types of Corrosion (Chemical and Electro Chemical)

Module – 3 : Water

Number of Class hours : 6 hours

Learning Outcomes : Students will be able to

- ✓ Discuss hard and soft water. **K₂**
- ✓ Tell unit of hardness (mg / litre & ppm). **K₁**
- ✓ Discuss the cause of Hardness. **K₂**
- ✓ Solve numerical problems based on Hardness. **K₃**
- ✓ Discuss disadvantages of Hard water and hence their removal. (special reference to Zeolite process and de-ionisation). **K₂**
- ✓ Explain the concept of scale and sludge. **K₂**
- ✓ Find (estimate) hardness of water by EDTA method. **K₁**

Detailed content of the Unit:

Soft Water and Hard Water, causes of Hardness, Numerical Problems, Removal of Hardness – Permutit process(Zeolite process), Problems caused by the use of Hard water in Boiler (Scale and Sludge formation), De-ionisation of Water, Quantitative Measurement of Water Hardness by EDTA Method.

Module – 4 : Fuel and Lubricant

Number of Class hours : 6 hours

Learning Outcomes : Students will be able to

- ✓ Discuss and classify fuel and Differentiate between Gross and Net Chalorific value (HCV and LCV). **K₂**
- ✓ Explain rating of fuel (octane Number and Cetane Number). **K₂**

- ✓ Discuss coal (proximate and ultimate analysis). **K₂**
- ✓ Describe various fractions of Petroleum, their fractionating temperature and use. **K₁**
- ✓ Discuss various gaseous fuel (LPG, CNG, Water Gas, Coal Gas, Producer Gas and Bio Gas.. **K₂**
- ✓ Discuss lubricant and lubrication and to classify lubricant with example. **K₂**
- ✓ Describe characteristic property of good lubricant. **K₂**
- ✓ Discuss some physical properties of lubricant (Oiliness, Flash and Fire point, Cloud and Pour point. **K₂**

Detailed content of the Unit:

Definition of Fuel, Classification of Fuel, Calorific values (HCV and LCV), Calculation of HCV and LCV using Dulong Formula, Proximate and Ultimate Analysis of Coal, Definition of Fuel, Classification of Fuel, Calorific values (HCV and LCV), Calculation of HCV and LCV using Dulong Formula, Proximate analysis of Coal, Fractional Distillation of Petroleum, Fuel rating (Octane and Cetane Number), Chemical composition, Calorific values and applications of LPG, CNG, Water Gas, Coal Gas, Producer Gas and Bio Gas. Definition, Classification with example, Function and Characteristic properties of good lubricant, Physical properties – Oiliness, Flash and Fire point, Cloud and Pour point.

Module –5 : Engineering Materials

Number of Class hours : 8 hours

Learning Outcomes : Students will be able to

- ✓ Discuss various Metallurgical terms (mineral, ore, Gangue, Flux, Slag). **K₂**
- ✓ Explain various extraction processes of Metals with special reference to Iron from Haematite Ore using Blast Furnace, Aluminium from Bauxite. **K₂**
- ✓ Discuss percentage composition, properties and uses of Ferrous and Non-ferrous alloys (Brass, Bronze, German Silver and Duralumin). **K₂**
- ✓ Discuss the raw material required for the manufacture of Portland cement and the percentage composition of various components of Portland Cement. **K₂**
- ✓ Explain the Principle behind setting and hardening of Portland Cement. **K₂**
- ✓ Discuss types of glass (at least three) example Borosil. **K₂**
- ✓ Describe refractory with suitable example brick. **K₂**
- ✓ Discuss and classify polymer. **K₂**
- ✓ Explain monomers of few commercially important Polymers. **K₂**
- ✓ Discuss the structure of Polymers and their monomer and differentiate between Thermosetting and thermo Plastic resin. **K₂**
- ✓ Illustrate the application of few Commercially important Polymer. **K₃**
- ✓ Explain Vulcanization of rubber and know their properties. **K₂**

Detailed content of the Unit:

Natural Occurrence of metals – Minerals, Ores of Iron, Aluminium and Copper, Gangue, Flux, Slag, Extraction of – Iron from Haematite Ore using Blast Furnace, Aluminium from Bauxite, Alloys – definition, Identify percentage composition, properties and uses of Ferrous and Non-ferrous alloys (Brass, Bronze, German Silver and Duralumin), Portland Cement – composition, raw materials, Setting and Hardening of Cement. Glass – definition, types and raw materials, Refractory – definition and example, Polymers – definition, classification of Polymers, simple reaction involved in preparation and their application of thermoplastic and thermo setting plastics (using PVC, Bakelite, Teflon, neoprene, buna-s, Nylon – 6 and Nylon – 6-6) Vulcanization of rubber.

References / Suggested learning resources:

BOOKS:

Text book of Chemistry for Class XI and Class XII (Part I and Part II) NCERT, Delhi 2017-18

- Agarwal & Shikha, Engineering Chemistry Cambridge University Press, New Delhi – 2015
- Dara S S and Dr S. S. Umare Engineering Chemistry, S Chand Publication, New Delhi - 2015
- Dr Aloka Debi, Chemistry I and II, Bhagabati Prakasani
- Jain & Jain, Engineering Chemistry, Dhanpat Rai Publishing Co.
- B. K. Sharma, Engineering Chemistry, Goel Publishing House
- Applied Chemistry I and II, Dr. Raman Rani Mittal, S K Kataria & Sons

Open source software and website address:

- www.chemguide.co.uk/atommenu.html (atomic structure and chemical bonding)
- www.visionlearning.com (atomic structure and chemical bonding)
- <http://www.wastewaterlearning.com/elearning/> (water treatment)
- www.capital-refractories.com (metals, alloys, cement and refractory material)
- www.em-ea.org/guide%20books/book-2/2.1%20fuels%20and%20combustion.pdf (fuel and conversion)

Communication Skills in English

Course Code	:	HS104
Course Title	:	Communication Skills in English
Number of Credits	:	2 (L: 2, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	HS

Course outcomes:

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

CO1 Develop conceptual knowledge of communication skill - K2

CO2 Demonstrate technical communication skills both in verbal and written format – K3

CO3 Apply the knowledge of soft skills for professional excellence – K3

CO4 Construct grammatically correct independent sentences and long texts – K3

CO5. Develop various life skills related to professional communication –K3

Unit-1 Communication: Theory and Practice (12 Marks)

Number of Class hours: 8

Learning Outcome:

- i) Explain the basic concepts of communication skills –K1
- ii) Analyse the factors of effective communication – K2
- iii) Design the modes of technical communication – K3

Detailed Content

- **Basics of communication:**

Introduction, meaning and definition, process of communication etc

- **Types of communication:**

(Formal and informal, verbal, non-verbal and written Barriers to effective communication)

- **7 Cs for effective communication**

(Considerate, concrete, concise, clear, complete, correct, courteous)

- **Art of Effective communication (Body Language)**

(Choosing words, Voice Modulation, Clarity, posture and gestures)

C/H-2

- **Technical Communication.** (Types and examples)

C/H-6

Business Letters (written), telephonic conversations (oral)

Report Writing – Types, Structures, Data Collection, Content, Form

Writing a Proposal, Recommendation, Instruction

Unit-2 Soft Skills for Professional Excellence (12 Marks)

Number of Class hours: 8

Learning Outcome:

- i) Learn the importance of soft skills in one's personal and professional life –K2
- ii) Outline various life skills related to professional communication – K3
- iii) Apply soft skills for professional excellence-K3

Detailed Content

- **Introduction:** Soft Skills and Hard Skills - Importance of soft skills

C/H-2

- **Life skills:** Self-awareness and Self-analysis, adaptability, resilience, emotional intelligence, empathy etc

C/H-2

- **Applying soft skills across cultures**

(Examples of beliefs and customs of community and ethnicity)

C/H-2

• **Case Studies**

(Examples of implementation of soft skill for professional success)

C/H-2

Unit-3: Reading Comprehension (12 Marks)

Number of Class hours: 8

Learning Outcome:

- i) Comprehend a given text K2
- ii) Analyse the content words- K2
- iii) Restate the vocabulary to express in verbal and written communication.- K3

Detailed Content

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

Section-1 (Prose)

C/H-4

Malgudi Days: R.K. Narayan

“Uncle Podger Hangs a Picture” Jerome K. Jerome

Section-2 (Poems)

C/H-4

Night of the Scorpion by Nissim Ezekiel

Stopping by Woods on a Snowy Evening by Robert Frost

Where the Mind is Without Fear by Rabindranath Tagore

Ode to Tomatoes by Pablo Neruda

Unit-4: Professional Writing (12 Marks)

Number of Class hours: 10

Learning Outcome:

- i) Write Business and personal letters –K3
- ii) Develop précis out of a given text –K3
- iii) Draft a written text meant for professional communication.-K3

Detailed Content

- | | |
|---|-------|
| 1. The art of précis writing | C/H-2 |
| 2. Letters: personal and business | C/H-2 |
| 3. Drafting e-mails, notices, minutes of a meeting, Memos | C/H-2 |
| 4. Writing Proposals, Reports, Instruction. | C/H-4 |

Unit-5: Vocabulary and Grammar (12 Marks)

Number of Class hours: 08

Learning Outcome:

- i) Expand the vocabulary of commonly used words, Idioms and Phrases. – K1
- ii) Explain grammatical functions of words and punctuation marks – K2
- iii) Apply appropriate vocabulary and grammar in spoken and written language –K3

Detailed Content

1. Vocabulary:

Synonym and antonym of commonly used words (at least 20)

One-word substitution (at least 20)

Idioms and phrases (at least 20) C/H-2

2. Remedial Grammar C/H 4

Parts of speech, Determiners, Modals, degree of comparison, Subject-Verb Agreement

Voice (Active and Passive)

Sentence type and structure

(Types: declarative, interrogative, imperative, exclamatory, optative;

Structure: simple, compound, complex)

Tenses (structure and example)

(Transformation of sentences without changing the meaning based on the grammatical functions)

3. **Punctuation** (functions and proper use of punctuation marks in written text) C/H-2

List of Recommended Study Materials:

Books

1. Wren and Martin, English Grammar and Composition, S Chand & Company Limited, New Delhi.
2. Kulbhushan Kumar, Effective Communication Skills, Khanna Publishing House, New Delhi (Revised Edition 2018)
3. M. Ashraf Rizvi. Effective Technical Communication. Mc-Graw Hill: Delhi, 2002.
4. Oxford Advanced Learner's Dictionary, OUP
5. Roget's Thesaurus of English Words and Phrases
6. English for Polytechnics by Dr Pappi Rani Barooah (Eastern Book House Publishers)
7. Technical Communication, Meenakshi Raman & Sangeeta Sharma, Oxford University Press
8. Communication Skills, Pushplata, Sanjay Kumar, Oxford University Press

Web

1. Swayam MOOC. (English, communication skill and soft skill courses) www.swayam.gov.in
2. Malgudi Days (<https://archive.org/details/NarayanRKMalgudiDays>)
3. "Uncle Podger Hangs a Picture" Jerome K. Jerome
(<https://docplayer.net/20977136-Uncle-podger-hangs-a-picture.html>)
4. <https://allpoetry.com>
5. <https://www.skillsconverged.com>
6. <https://learnenglishteens.britishcouncil.org>

Engineering Graphics

Course Code	:	ES105
Course Title	:	Engineering Graphics
Number of Credits	:	1.5 (L: 0, T: 0, P:3)
Prerequisites	:	NIL
Course Category	:	ES

Course Outcomes

Following outcomes will be achieved:

- 1) Select and construct appropriate drawing scales, use drawing equipment's, and understand Indian Standards of engineering drawing (K3)
- 2) Draw views of given object and components (K2)
- 3) Sketch orthographic projections into isometric projections and vice-versa (K3).
- 4) Apply computer aided drafting tools to create 2D engineering drawings(K3)

Course Content

Unit – I Basic elements of Drawing

No. of Lectures required: 5

Unit Learning Outcomes:

1. Know and understand the conventions and method of engineering drawing(K1)
2. Interpret engineering drawings using fundamental technical mathematics(K2)
3. Construct basic and intermediate geometry(K3)

Contents:

Drawing Instruments and supporting materials: method to use them with applications.

Convention of lines and their applications.

Representative Fractions – reduced, enlarged and full size scales;
Engineering Scales such as plain and diagonal scale.

Dimensioning techniques as per SP-46:2003 – types and applications of chain, parallel and coordinate dimensioning.

Geometrical and Tangency constructions. (Redraw the figure)

Unit – II Orthographic projections

No. of Lectures required: 8

Unit Learning Outcomes:

1. Identify the principle views and types of lines used in orthographic projection(K2)
2. Identify auxiliary and sectional views(K2)

Contents:

Introduction of projections-orthographic, perspective, isometric and oblique: concept and applications. (No question to be asked in examination).

Introduction to orthographic projection, First angle and Third angle method, their symbols.

Conversion of pictorial view into Orthographic Views – object containing plain surfaces, slanting surfaces, slots, ribs, cylindrical surfaces. (use First Angle Projection method only)

Unit – III Isometric Projections

No. of Lectures required: 8

Unit Learning Outcomes:

1. Set up and use a drawing board to effectively draw 3D shapes(K2)
2. Draw isometric view and isometric projection of planes and solids(K3)

Contents:

Introduction to isometric projections. Isometric scale and Natural scale. Isometric view and isometric projection. Illustrative problems related to objects containing lines, circles and arcs shape only. Conversion of orthographic views into isometric view/projection.

Unit – IV Free Hand Sketches of engineering elements

No. of Lectures required: 5

Unit Learning Outcomes:

1. Enables visualization of an idea in the form of a sketch(K2)
2. Synthesize the use of two-dimensional and three-dimensional drawing(K3)

Contents:

Freehand sketches of machine elements: Thread profiles, nuts, bolts, studs, setscrews, washer, Locking arrangements. (For branches other than mechanical Engineering, the teacher should select branch specific elements for free hand sketching)

Free hand sketches of orthographic view (on squared graph paper) and isometric view (on isometric grid paper)

Unit – V Computer aided drafting**No. of Lectures required: 12-16****Unit Learning Outcomes:**

1. Use interface, command panel, menus and command icons(K2)
2. Setting up file features, units, limits, grid, snap, undoing and redoing action(K2)
3. Create basic drawing with drawing commands in AutoCAD (K2)
4. Modify and reform the objects that created in virtual environment(K3)
5. Use AutoCAD's plotter setting and print out the drawing in AutoCAD in proper format(K3)

Contents:

Computer Aided Drafting: concept. Hardware and various CAD software available. System requirements and Understanding the interface. Components of AutoCAD software window: Title bar, standard tool bar, menu bar, object properties tool bar, draw tool bar, modify tool bar, cursor cross hair. Command window, statusbar, drawing area, UCS icon. File features: New file, Saving the file, Opening an existing drawing file, Creating templates, Quit. Setting up new drawing: Units, Limits, Grid, Snap. Undoing and redoing action. Draw basic entities like Line, Circle, Arc, Polygon, Ellipse, Rectangle, Multiline, Poly Line. Method of Specifying points: Absolute coordinates, Relative Cartesian and Polar coordinates. Modify and edit commands like trim, extend, delete, copy, offset, array, block, layers. Dimensioning: Linear, Horizontal Vertical, Aligned, Rotated, Baseline, Continuous, Diameter, Radius, Angular Dimensions. Dim variable. Editing dimensions. Text: Single line Text, Multiline text.

Standard sizes of sheet. 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 Tee and Set squares/ drafter. (do this exercise in sketch book)	I	02
2	Write alphabets and numerical (Vertical only) (do this exercise in sketch book)	I	02
3	Draw regular geometric constructions and redraw the given figure (do this exercise in sketch book) Part I	II	02
4	Draw regular geometric construction and redraw the given figure (do this exercise in sketch book) Part II	II	02
5	Draw a problem on orthographic projections using first angle method of projection having plain surfaces and slanting. Part I	III	02
6	Draw another problem on orthographic projections using first angle method of projection having slanting surfaces with slots. Part II	III	02
7	Draw two problems on orthographic projections using first angle method of projection having cylindrical surfaces, ribs. Part I	III	02
8	Draw two problems on Isometric view of simple objects having plain and slanting surface by using natural scale. Part I	IV	02
9	Draw some problems on Isometric projection of simple objects having cylindrical surface by using isometric scale. Part I	IV	02
10	Draw free hand sketches/ conventional representation of machine elements in sketch book such as thread profiles, nuts, bolts, studs, set screws, washers, Locking arrangements. Part I	V	02
11	Problem based Learning: Given the orthographic views of at least three objects with few missing lines, the student will try to imagine the corresponding objects, complete the views and draw these views in sketch book. Part I	III, II, V	02
12	Draw basic 2D entities like: Rectangle, Rhombus, Polygon using AutoCAD (Print out should be a part of progressive assessment). Part I	V	02
13	Draw basic 2D entities like: Circles, Arcs, circular using AutoCAD (Print out should be a part of progressive assessment). Part II	V	02
14	Draw basic 2D entities like: Circular and rectangular array using AutoCAD (Print out should be a part of progressive assessment). Part III	V	02
15	Draw blocks of 2D entities comprises of Rectangle, Rhombus, Polygon, Circles, Arcs, circular and rectangular array, blocks using AutoCAD (Print out should be a part of progressive assessment). Part IV	V	02
16	Draw basic branch specific components in 2D using AutoCAD (Print out should be a part of term work). Part I	V	02
17	Draw complex branch specific components in 2D using AutoCAD (Print should be a part of progressive assessment). Part I	V	02
	Total		34

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.

Software/Learning Websites

1. <https://www.youtube.com/watch?v=TJ4jGyD-WCw>
2. https://www.youtube.com/watch?v=dmt6_n7Sgcg
3. 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/courses/me2011/handouts/engg%20graphics.pdf>
7. <https://www.machinedesignonline.com>

Engineering Workshop Practice

Course Code:	ES106
Course Title:	Engineering Workshop Practice
Number of Credits:	1.5 (L: 0, T: 0, P: 3)
Prerequisites:	NIL
Course Category:	ES

(For All Branches Excluding Medical Laboratory Technology & Fashion Technology)

Course Objectives:

- C.O.1: To understand basic engineering processes for manufacturing and assembly (K2).
- C.O.2. To understand, identify, select and use various marking, measuring, and holding, striking and cutting tools and equipment's (K3)
- C.O.3: To understand and interpret job drawings, produce jobs, and inspect the job for specified dimensions (K2)
- C.O.4: To understand the various types of wiring systems and acquire skills in house wiring (K3)
- C.O.5: To understand, operate, control different machines and equipment's adopting safety practices (K2)

Learning Outcome:

- I. Students will be able to know different wood working tools / machines and its applications/ operations.
- II. Students will be able to know different fitting tools / machines and its applications/ operations.
- III. Students will be able to know different welding tools/ machines and its applications/ operations.
- IV. Students will be able to know different Sheet Metal tools / machines and its applications/ operations.
- V. Students will be able to do simple of house wiring
- VI. Students will be able to measure voltage, current, power, etc.

Course Content:

Sl. No.	Name of The Shops	Details Of Practical Content
I	Carpentry Shop:	i) Demonstration of different wood working tools / machines. ii) Demonstration of different wood working processes, like planing, marking, chiselling, grooving, turning of wood etc. iii) One simple job involving any one joint like mortise and tenon, dovetail, bridge, half lap etc.
II	Fitting Shop	i) Demonstration of different fitting tools and drilling machines and power tools ii) Demonstration of different operations like chipping, filing, drilling, tapping, sawing, cutting etc. iii) One simple fitting job involving practice of chipping, filing, drilling, tapping, cutting etc
III	Welding Shop	i) Demonstration of different welding tools / machines. ii) Demonstration on Arc Welding, Gas Welding, MIG, MAG welding, gas cutting and rebuilding of broken parts with welding. iii) One simple job involving butt and lap joint
IV	Sheet Metal Working Shop	i) Demonstration of different sheet metal tools / machines. ii) Demonstration of different sheet metal operations like sheet cutting, bending, edging, end curling, lancing, soldering, brazing, and riveting. iii) One simple job involving sheet metal operations and soldering and riveting.
V	Electrical Workshop	Electrical House Wiring Shop: Practice on simple lamp circuits (i) one lamp controlled by one switch by surface conduit wiring, (ii) Lamp circuits- connection of lamp and socket by separate switches, (iii) Connection of Fluorescent lamp/tube light, (iv) simple lamp circuits-install bedroom lighting. And (v) Simple lamp circuits-install stair case wiring.
VI	Electrical Workshop	Demonstration: i) Demonstration of measurement of Current, Voltage, Power and Energy. ii) Demonstration of advance power tools, pneumatic tools, electrical wiring tools and accessories. iii) Tools for Cutting and drilling

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

Engineering Workshop Practice

(For Medical Laboratory Technology Only)

Course Outcomes:

Students will be able to

CO1: Remember formula to prepare different laboratory solutions. CO2: Students will be able to understand principles of preliminary biochemical test of carbohydrate and protein. (K1)

CO3: Understand measures of laboratory safety. (K2)

CO4: Prepare different laboratory solutions and perform preliminary biochemical test of carbohydrate and protein. (K3)

CO5: Analyse results of preliminary biochemical test of carbohydrate and protein. (K4)

Detailed Content:

A. Medical laboratory shop

1. Preparation of solutions a. Normal solution, molar solution, molal solution b. W/V, V/V, % solution etc.
2. Introduction to qualitative biochemical tests for identification of carbohydrates.
3. Vitamins and Minerals a. Fat soluble vitamins : Vit – A, D, E, K b. Water soluble Vitamins: Vit – C, B- complex
4. Biochemical tests for Proteins (Colour Reactions) a. Biuret Test b. Ninhydrin Test
5. Experiments on blood a. Preparation of blood smear and staining b. Observation of blood smear under microscope c. Separation of plasma and serum from blood d. Detection of BT and CT of blood

B. Laboratory safety

B.1 Electrical safety of MLT Lab

1. General safety & precautions of Medical Laboratories
2. Electric shock, precaution & treatment measure.
3. Fuse and safety measure using MCB etc for Medical Laboratory equipments.
4. General rules of Earthing as safety measure.
5. Common Medical Devices.
6. Standard electrical wiring materials.
7. Testing of different equipments & laboratory instruments.

B.2 Chemical safety of MLT Lab

1. Handling of Acids & Bases.
2. Safety upon spilling of chemicals.
3. Storage & refrigeration of chemicals.
4. Storage of Reagents & Kits.
5. Laboratory first-aid

Engineering Workshop Practice

(For Fashion Technology Only)

After completing this programme Students will be able to-

- 1) Remember or acknowledged all tools and equipments used for drawing. (K1)
- 2) Understand & perform drawing of basic outlines used in different fashion diagram (K2)
- 3) Understand the concept of basic anatomy figure of Man and Woman (K2)
- 4) Understand the skills required for drawing different basic design on square paper (K2).
- 5) Learn to identify different parts of the Sewing machine and their functions. Identify descriptively
the tools used in the different fashion designing processes (K2).
- 6) Understand the basics of quality of different fabric sample. Learn to identify the texture & aesthetic appearance of different products (K2).
- 7) Understand and adopting good interpersonal skills to develop basic block , Print design on fabric (K3).

Content:

1. Knowledge of drawing equipments and tools : paper, markers and pencils of different grades (HB,B,2B,4B,6B),drawing board, ruler, different media (charcoal, ink, water color, color pencils etc).
2. Illustrate different types of lines: vertical, horizontal, diagonal, zigzag, curved, thick and thin.
3. Sketching a basic 8-head figure anatomy of a woman and man.
4. Basic design skills of square area on paper: Stripes, checks, geometrical, floral, abstract etc.
5. Knowledge of different measuring and cutting equipments and tools: Tape, Dress forms, L-scale, hip curve, French curve, Scissors (paper/fabric)
6. Color exercises on: color wheel- primary, secondary, warm, cool, and tertiary value and shades etc.
7. Knowledge on parts of basic sewing machines and its operations.
8. Preparation of a catalogue of different fabric samples.
9. Prepare a basic block designs on paper for cutouts.
10. Use of basic block design cutouts and fabric colors on the surface of any cotton fabrics.

Applied Physics- I Lab

Course Code	BS107
Course Title	Applied Physics-I Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Nil
Course Category	Basic Science

Course Outcome:-

Students will be able to:-

C.O.1: Use Vernier calliper & Screw gauge to measure different dimensions of solid bodies. (K3)

C.O.2: Analyse the laws of forces and verify the conservation laws. (K4)

C.O.3: Categorise the different properties of matter by measuring their values. (K4)

C.O.4: Use temperature measuring instruments. (K3)

List of Practical's/ Activities (To perform minimum 6 practical).

1. To measure length, radius of a given cylinder, a test tube and a beaker using a Vernier caliper.
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 verify law of conservation of mechanical energy (PE to KE).
7. To determine force constant of a spring using Hook's Law.
8. To find the viscosity of a given liquid (Glycerin) by Stoke's law.
9. To determine atmospheric pressure at a place using Fortin's barometer.
10. To measure room temperature and temperature of a hot bath using mercury thermometer and convert it into different scales.

Applied Chemistry Lab

Course Code	BS108
Course Title	Applied Chemistry Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Nil
Course Category	Basic Science

Applied Chemistry Lab

CO1: Prepare different standard solution

CO2: Analyse strength of different solution

CO3: Judge different ores

CO4: Analyse the rural and urban water sample

CO5: Explain the uses and properties of lubricant

CO6: Test different coal sample

CO7: Differentiate the properties of solid and liquid fuel

Perform any six experiments

1. Preparation of standard solution of oxalic acid or potassium permanganate.
2. Standardization of potassium permanganate solution using standard oxalic acid.
3. Determination of strength of given sodium hydroxide solution by titrating against standard oxalic acid solution using phenolphthalein indicator.
4. Iodometric estimation of copper in the pyrite ore.
5. Volumetric estimation of total hardness of given water sample using standard EDTA solution.
6. Volumetric estimation of alkalinity of given water sample using 0.01M sulphuric acid.
7. Determination of conductivity of given water sample.
8. Proximate analysis of coal
 - a) Gravimetric estimation moisture in given coal sample.
 - b) Gravimetric estimation ash in given coal sample.
9. Determination of flash and fire point of lubricating oil using Able's flash point apparatus.
10. Determination of calorific value of solid or liquid fuel using bomb calorimeter.

Sports & Yoga

Course Code	HS109
Course Title	Sports & Yoga
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Nil
Course Category	Humanities & Social Science

Course Content:

- **Introduction to Physical Education**
 - Meaning & definition of Physical Education
 - Aims & Objectives of Physical Education
 - Changing trends in Physical Education
- **Olympic Movement**
 - Ancient & Modern Olympics (Summer & Winter)
 - Olympic Symbols, Ideals, Objectives & Values
 - Awards and Honours in the field of Sports in India (Dronacharya Award, Arjuna Award, Dhyanchand Award, Rajiv Gandhi Khel Ratna Award etc.)
- **Physical Fitness, Wellness & Lifestyle**
 - Meaning & Importance of Physical Fitness & Wellness
 - Components of Physical fitness
 - Components of Health related fitness
 - Components of wellness
 - Preventing Health Threats through Lifestyle Change

- Concept of Positive Lifestyle
- **Fundamentals of Anatomy & Physiology in Physical Education, Sports and Yoga**
 - Define Anatomy, Physiology & Its Importance
 - Effect of exercise on the functioning of Various Body Systems. (Circulatory System, Respiratory System, Neuro-Muscular System etc.)
- **Kinesiology, Biomechanics & Sports**
 - Meaning & Importance of Kinesiology & Biomechanics in Physical Edu. & Sports
 - Newton's Law of Motion & its application in sports.
 - Friction and its effects in Sports.
- **Postures**
 - Meaning and Concept of Postures.
 - Causes of Bad Posture.
 - Advantages & disadvantages of weight training.
 - Concept & advantages of Correct Posture.
 - Common Postural Deformities – Knock Knee; Flat Foot; Round Shoulders; Lordosis, Kyphosis, Bow Legs and Scoliosis.
 - Corrective Measures for Postural Deformities
- **Yoga**
 - Meaning & Importance of Yoga
 - Elements of Yoga
 - Introduction - Asanas, Pranayama, Meditation & Yogic Kriyas
 - Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana & Shashankasana)
 - Relaxation Techniques for improving concentration - Yog-nidra
- **Yoga & Lifestyle**
 - Asanas as preventive measures.
 - Hypertension: Tadasana, Vajrasana, Pavan Muktasana, Ardha Chakrasana, Bhujangasana, Sharasana.
 - Obesity: Procedure, Benefits & contraindications for Vajrasana, Hastasana, Trikonasana, Ardh Matsyendrasana.
 - Back Pain: Tadasana, Ardh Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana.

- Diabetes: Procedure, Benefits & contraindications for Bhujangasana, Paschimottasana, Pawanuktasana, Ardh Matsyendrasana.
- Asthma: Procedure, Benefits & contraindications for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana.

- **Training and Planning in Sports**

- Meaning of Training
- Warming up and limbering down
- Skill, Technique & Style
- Meaning and Objectives of Planning.
- Tournament – Knock-Out, League/Round Robin & Combination.

- **Psychology & Sports**

- Definition & Importance of Psychology in Physical Edu. & Sports
- Define & Differentiate Between Growth & Development
- Adolescent Problems & Their Management
- Emotion: Concept, Type & Controlling of emotions
- Meaning, Concept & Types of Aggressions in Sports.
 - Psychological benefits of exercise.
 - Anxiety & Fear and its effects on Sports Performance.
 - Motivation, its type & techniques.
 - Understanding Stress & Coping Strategies.

- **Doping**

- Meaning and Concept of Doping
- Prohibited Substances & Methods
- Side Effects of Prohibited Substances

- **Sports Medicine**

- First Aid – Definition, Aims & Objectives.
- Sports injuries: Classification, Causes & Prevention.
- Management of Injuries: Soft Tissue Injuries and Bone & Joint Injuries

- **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.

- History of the Game/Sport.
- Latest General Rules of the Game/Sport.
- Specifications of Play Fields and Related Sports Equipment.
- Important Tournaments and Venues.
- Sports Personalities.
- Proper Sports Gear and its Importance.

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)

Course Outcomes:

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

- (i) Practice Physical activities and Hatha Yoga focusing on yoga for strength, flexibility, and relaxation.
- (ii) Learn techniques for increasing concentration and decreasing anxiety which leads to stronger academic performance.
- (iii) Learn breathing exercises and healthy fitness activities
- (iv) Understand basic skills associated with yoga and physical activities including strength and flexibility, balance and coordination.
- (v) Perform yoga movements in various combination and forms.
- (vi) Assess current personal fitness levels.
- (vii) Identify opportunities for participation in yoga and sports activities.
- (viii) Develop understanding of health-related fitness components: cardiorespiratory endurance, flexibility and body composition etc.
- (ix) Improve personal fitness through participation in sports and yogic activities.
- (x) Develop understanding of psychological problems associated with the age and lifestyle.

- (xi) Demonstrate an understanding of sound nutritional practices as related to health and physical performance.
- (xii) Assess yoga activities in terms of fitness value.
- (xiii) Identify and apply injury prevention principles related to yoga and physical fitness activities.
- (xiv) Understand and correctly apply biomechanical and physiological principles related to exercise and training.

Communication in English Lab

Course Code	:	HS110
Course Title	:	Communication Skills in English - Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	NIL
Course Category	:	HS

Course Outcome:

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

CO1 Develop active listening skills and become efficient communicator –K2

CO2 Apply the knowledge of phonetics for better pronunciation – K3

CO3 Utilize non-verbal communication skills in oral presentations.- K3

CO4 Demonstrate oneself as an efficient user of applied grammar and appropriate vocabulary.- K3

CO5 Develop sense of self responsibility to communicate effectively at professional level in general and at personal level in particular.-K4

Unit I Listening Skills (08 Marks)

Number of Class hours: 6

Learning Outcome:

- i) Explain the process of active listening –K3
- ii) Analyse the content to be communicated –K2

Detailed Content

Listening Process and Practice:

(Activity with recorded lectures, poems, interviews and speeches)

C/H 6

Practical Lab Activity:

Listen to a material and respond accordingly.

Unit II Introduction to Phonetics (08 Marks)

Number of Class hours: 8

Learning Outcome:

- i) Describe human speech sounds with corresponding phonetic symbols – K1
- ii) Transcribe from English to phonetic scripts and vice versa – K3
- iii) Explain the content in own words.- K3

Detailed Content

1. Speech Sounds: Practice of vowels, consonants with corresponding IPA Symbols C/H 2

2. Transcription: from English to phonetic script and vice versa C/H 2

3. Syllable division and word stress patterns: intensive practice for learning Received Pronunciation (RP) and General Indian English (GIE). C/H 2

4. Intonation: Practice of for learning Received Pronunciation C/H 2

Practical Lab Activity:

1. Write and pronounce IPA symbols of Vowels and Consonants.
2. Working with Syllable, Stress, Accent and Intonations.
3. Transcribe a small text/ pronounce a small transcribed text

Unit III Speaking Skills (08 Marks)

Number of Class hours: 10

Learning Outcome:

- i) Categorise various modes of oral presentations – K2
- ii) Design and present audio visual aided presentations- K3
- iii) Demonstrate interpersonal skills through conversations.- K3

Detailed Content

1. Oral Presentations:

Impromptu and extempore speech, public speaking, Group discussion C/H 6

2. Business presentations: (Audio Visual aided) C/H 2

3. Conversation practice: Role playing and Debate on pre selected topics C/H 2

Practical Lab Activity:

1. GD on pre-selected topic
2. Oral presentation/Public speaking on pre-selected topic
3. Debate on pre-selected topic

4. Role Play and Lively Conversations in given formal/informal situation.
5. Business Presentation using audiovisual aids on pre-selected topics

Unit IV Building vocabulary (08 Marks)

Number of Class hours: 8

Learning Outcome:

- i) Construct the exact vocabulary and phrases in communication –K3
- ii) Utilize a set of vocabulary in oral and written expressions.- K3
- iii) Demonstrate significant improvement in stock of vocabulary.-K3

Detailed Content

Word formation: (at least 10 each)	C/H 2
Phrasal verbs: Study of Selected phrasal verbs (at least 20)	C/H 2
Learning foreign phrases: Study of Selected words (at least 20)	C/H 2
Jargon/ Register: study of words related to organizational set up (at least 20 each)	C/H 2

Practical Lab Activity:

1. Word exercises and word games to enhance self-expression and vocabulary of participants.

Unit V Applied Grammar & Composition (08 Marks)

Number of Class hours: 8

Learning Outcome:

- i) Identify the grammatical function of words –K2
- ii) Construct grammatically accurate sentences.- K3
- iii) Demonstrate skill of writing long text using correct grammatical structures.-K3

Detailed Content

1. Sentence correction and Error analysis based on grammatical functions:

(Prepositions, conjunctions, modals, determiners, tense etc.) C/H 2

2. Joining and splitting of various types of sentences. C/H 2

3. Reporting: (interchange of direct and indirect speech) C/H 1

4. Writing correctly in real life situations

(Letters, petitions, articles, competitive essays etc .) C/H 2

5.Voice Change (Active to passive voice and vice versa) C/H 1

Practical Lab Activity:

1. Editing sentences or paragraphs with grammar corrections
2. Join or Split sentences
3. Compose grammatically correct texts

List of Recommended Study Materials:

Books

1. Wren and Martin, English Grammar and Composition, S Chand & Company Limited, New Delhi.
2. Kulbhushan Kumar, Effective Communication Skills, Khanna Publishing House, New Delhi
(Revised Edition 2018)
3. M. Ashraf Rizvi. Effective Technical Communication. Mc-Graw Hill: Delhi, 2002.
4. English for Polytechnics by Dr Pappi Rani Barooah (Eastern Book House Publishers)
5. Technical Communication, Meenakshi Raman & Sangeeta Sharma, Oxford University Press
6. Communication Skills, Pushplata, Sanjay Kumar, Oxford University Press

7. Kulbhushan Kumar, Effective Communication Skills, Khanna Publishing House, New Delhi (Revised Ed. 2018)
8. J.D.O'Connor. Better English Pronunciation. Cambridge: Cambridge University Press, 1980.
9. Margaret M. Maison. Examine your English. Orient Longman: New Delhi, 1964.
10. T. Balasubramanian. A Textbook of English Phonetics for Indian Students. New Delhi: Macmillan India Ltd, 2000.

Web

1. Swayam MOOC (English and communication skill courses) www.swayam.gov.in
2. <https://www.internationalphoneticassociation.org>
3. <https://positivepsychology.com/communication-games-and-activities/>
4. <https://www.grammarbank.com/english-vocabulary-exercises.html>

Detailed First Year Curriculum Contents

(Semester II)

Mathematics II

Course Code	BS 201
Course Title	Mathematics – II
Number of Credits	4 (L: 3, T: 1, P: 0)
Prerequisites	NIL
Course Category	BS

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 & second Order Differential Equations.

Course Outcomes:

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

C.O.1: Solve different problems related to Matrices and Determinants for applications in various Engineering problems. (K3)

C.O.2: Evaluate integration of different functions for applications in the field of Engineering and their higher course of studies. (K5)

C.O.3: Identify the basic about geometry and realize that the coordinate geometry provides a connection between algebra and geometry through graphs of lines and curves. (K4)

C.O.4: Determine the amount of work done and the moment or torque on application of forces. (K5)

C.O.5: Solve differential equations and apply them in different Engineering problems. (K3)

Course Content:

Module - I: Determinants and Matrices

Number of Class hours: 10

Learning Outcomes:

1. Use Matrices for presentation of large data in an organised expression.(K3)
2. Applying algebraic operations on matrices under certain conditions.(K3)
3. Analysis and solution of system of linear equations.(K4)

Detailed content of the unit:

- 1) Definition & Expansion of determinants of order 2 & 3.
- 2) Elementary properties of determinants upto 3rd order.
- 3) Minors & Cofactors.
- 4) Consistency of equations, Cramer's rule.
- 5) Definition of a matrix of order $m \times n$.
- 6) Types of matrices-null matrix, square matrix, diagonal matrix, identity matrix etc.
- 7) Symmetric and skew symmetric matrices.
- 8) Algebra of matrices-addition, subtraction, scalar multiplication, multiplication of matrices.
- 9) Inverse of a matrix
- 10) Matrix inverse method to solve a system of linear equations in 3 variables.

Module - II: Integral Calculus

Number of Class hours: 12

Learning Outcomes:

- 1) Explain the meaning of Integration.(K4)
- 2) Learn to use different methods of Integration.(K3)
- 3) Apply different properties of definite integral to solve problems.(K3)
- 4) Apply definite integral in calculation of area and volume.(K3)

Detailed content of the unit:

- 1) Concept of Integration: Integration as inverse operation of differentiation.
- 2) Fundamental Theorem of Integral calculus
- 3) Simple integration by substitution.
- 4) Integration by parts
- 5) Integration by partial fractions (for linear factors only).
- 6) Use of formulas $\int_0^{\frac{\pi}{2}} \sin^n x \, dx$, $\int_0^{\frac{\pi}{2}} \cos^n x \, dx$ and $\int_0^{\frac{\pi}{2}} \sin^m x \cos^n x \, dx$ for solving problems where m and n are positive integers.
- 7) Properties of definite Integral.
- 8) Applications of integration for - i). Simple problem on evaluation of area bounded by a curve and axes. ii). Calculation of Volume of a solid formed by revolution of an area about axes - Simple problems.

Module - III: Co-ordinate Geometry

Number of Class hours: 10

Learning Outcomes:

- 1) Identify and use of Cartesian and Polar co-ordinates. (K4)
- 2) Identify different forms of straight lines, their formation and some properties with respect to each other.(K4)
- 3) Analyzing different types of conic sections, their similarities and differences.(K4)

Detailed content of the unit:

- 1) Equation of straight line in various standard forms (without proof).
- 2) Intersection of two straight lines.
- 3) Angle between two lines.
- 4) Parallel and perpendicular lines.
- 5) Perpendicular distance formula.
- 6) General equation of a circle and its characteristics.
- 7) To find the equation of a circle, given: i) Centre and radius, ii) Three points lying on it and iii) Coordinates of end points of a diameter.
- 8) Definition of conics (Parabola, Ellipse, Hyperbola) their standard equations without proof.
- 9) Problems on conics when their foci, directrices or vertices are given.

Module - IV: Vector Algebra

Number of Class hours: 8

Learning Outcomes:

- 1) Apply the concept of directed line segment or vector and various laws related to it.(K3)
- 2) Apply products of vectors and application of the product.(K3)

Detailed content of the unit:

- 1) Definition, different types of vectors, rectangular resolution of a vector.
- 2) Addition and subtraction of vectors.
- 3) Scalar and vector products of two vectors with properties.
- 4) Problems related to scalar & vector product.
- 5) Simple problems related to work, moment and angular velocity.

Module – V: Differential Equations

Number of Class hours: 10

Learning Outcomes:

- 1) Identify different types of differential equation with respect to their order and degree.(K4)
- 2) Solve differential equations and apply them in different Engineering problems. (K3)

Detailed content of the unit:

- 1) Definition of ordinary differential equation, order & degree.
- 2) Solution of first order and first degree differential equation by i) variable separation method ii) homogeneous type, iii) exact type iv) Linear differential equation – simple problems.
- 3) Solution of 2nd order linear differential equation with constant coefficients - i) Evaluation of complementary functions, ii) Evaluation of Particular Integral(P.I) for exponential function, polynomial function, sine & cosine functions and functions of the form where V is any one of the above – simple examples.
- 4) MATLAB–Simple Introduction.

References:

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

Applied Physics II

Course Code	BS 202
Course Title	Applied Physics-II
Number of Credits	3 (L: 2, T: 1, P: 0)
Prerequisites	High School Level Physics
Course Category	Basic Science

Course Outcome:-

After the course the students will be able to-

CO1: Illustrate the phenomenon of Reflection & Refraction. (K3)

CO2: Identify the laws of electro-magneto statics to illustrate electrical components & instruments. (K4)

CO3: Explain and apply the Ohm's & Chirchoffs Laws to find solutions to electrical engineering problems.(K4)

CO4: Apply the concepts of semiconductor physics to identify the working of some modern electronic gadgets. (K3)

CO5: Explain the potential of LASER, nanotechnology and optical fibre in modern engineering & medical world. (K4)

Module- 1: Optics

Number of class hours: 3-4

Learning Outcomes:-

Students will be able to

- State basic optical laws. (K1)
- Illustrate the location of the images formed by mirrors and thin converging lens. (K3)
- Outline the conditions for total internal reflection. (K3)
- Outline the uses of microscope and telescope. (K2)

Content:-

Optics Basic optical laws; reflection and refraction, refractive index (expression and simple numerical problems), Images and image formation by lens, lens formula (expression only), power of lens, magnification and defects. Total internal reflection, Critical angle and conditions for total internal reflection, applications of total internal reflection in optical fiber.

Optical Instruments; Magnifying power, resolving power of simple and compound microscope and astronomical telescope in normal adjustment (Expression only), uses of microscope and telescope.

Module- 2: Electro-Magneto statics

Number of class hours: 6-7

Learning Outcomes:-

Students will be able to-

- Define electric field, electric lines of force, electric flux, potential difference, capacitor, capacitance, magnetic field, magnetic intensity, magnetic flux, magnetization and their units and properties. (K1)
- Explain the types of capacitor and types of magnetic material. (K2)
- Solve the simple numerical problems on capacitor and combination of capacitor. (K3)
- Explain the conversion of ammeter and voltmeter from galvanometer. (K4)

Content:-

Electrostatics Coulombs law, unit of charge, Electric field, Electric lines of force and their properties, Electric flux, Electric potential and potential difference, Gauss law: Application of Gauss law to find electric field intensity of straight charged conductor, plane charged sheet and charged sphere. Capacitor and its working, Types of capacitors, Capacitance and its units. Capacitance of a parallel plate capacitor, Series and parallel combination of capacitors (related numerical).

Electromagnetism Types of magnetic materials; dia, para and ferromagnetic with their properties, Magnetic field and its units, magnetic intensity, magnetic lines of force, magnetic flux and units, magnetization. Measuring instruments: Galvanometer, Ammeter, Voltmeter, Conversion of a galvanometer into ammeter and voltmeter.

Module- 3: Current Electricity

Number of class hours: 4-5

Learning Outcomes:-

Students will be able to

- Explain electric current, DC and AC current, concept of Resistance and its units, conductance, specific conductance,. Electric power, electric energy and its units. (K2)
- State Ohm's law, Kirchoff's law. (K1)
- Identify different resistances with their colour coding and the factors which affect their values. (K4)
- Apply the knowledge of electric energy over other form of energy to construct daily life appliances. (K3)

Content:- Current Electricity: Electric Current and its units, Direct and alternating current, Resistance and its units, Specific resistance, Conductance, Specific conductance, Series and parallel combination of resistances. Factors affecting resistance of a wire, carbon resistances and colour coding. Ohm's law and its verification, Kirchhoff's laws, Wheatstone bridge and its applications (slide wire bridge only), Concept of terminal potential difference and Electro motive force (EMF)

Heating effect of current, Electric power, Electric energy and its units (related numerical problems), Advantages of Electric Energy over other forms of energy.

Module- 4: Semiconductor Physics

Number of class hours: 10-12

Learning Outcomes:-

Students will be able to

- Explain the differences among insulators, semiconductors, conductors and intrinsic, extrinsic semiconductors. (K2)
- Apply the knowledge of diodes in rectifiers and various electronic circuits. (K3)
- Use the knowledge of semiconductor in various technical gadgets like mobile phones, computer, LED, photocells. (K3)

Content: - Semiconductor Physics Energy bands in solids, Types of materials (insulator, semiconductor, conductor), intrinsic and extrinsic semiconductors, p-n junction, junction diode and V-I characteristics, types of junction diodes. Diode as rectifier – half wave and full wave rectifier (centre taped). Transistor; description and three terminals, Types- pnp and npn, some electronic applications (list only). Photocells, Solar cells; working principle and engineering applications.

Module- 5: Modern Physics

Number of class hours: 10-12

Learning Outcomes:-

Students will be able to

- Explain spontaneous and stimulated emission, population inversion, optical pumping etc. (K2)
- Identify the use optical fibre and LASER in the field of medicine and communication engineering. (K4)
- Discuss the importance of nanoscience and nanotechnology. (K2)
- Identify the impact of nanotechnology to the society. (K4)

Content:- Lasers: Energy levels, ionization and excitation potentials; spontaneous and stimulated emission; population inversion, pumping methods, optical feedback, Types of lasers; Ruby, He-Ne and semiconductor (characteristics only), engineering and medical applications of lasers.

Fiber Optics: Introduction to optical fibers, light propagation, acceptance angle and numerical aperture (Expression only), fiber types, applications in; telecommunication, medical and sensors.

Nanoscience and Nanotechnology: Introduction, nanoparticles and nanomaterials, properties at nanoscale, nanotechnology, nanotechnology based devices and applications.

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, Ajoy Ghatak and K Thyagarajan, Cambridge University Press India Pvt. Ltd, New Delhi.
8. Nanoscience and Nanotechnology, KK Choudhary, Narosa Publishing House, Pvt. Ltd. New Delhi.
9. Nanotechnology: Importance and Applications, M.H. Fulekar, IK International Publishing House Pvt. Ltd, New Delhi.
10. e-books/e-tools/ learning physics software/websites etc.

Introduction to IT Systems

Course Code	ES 203
Course Title	Introduction to IT Systems
Number of Credits	2 (L: 2, T: 0, P: 0)
Prerequisites (Course code)	NIL
Course Category	ES

Course Outcomes:

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

- C.O.1: Comfortably work on Computer (**K2**)
- C.O.2: Install and Configure Operating System (**K3**)
- C.O.3: Assemble a PC and connect it to external devices (**K3**)
- C.O.4: Write documents, create worksheets, and prepare presentations (**K2**)
- C.O.5: Protect information and computers from basic abuses/attacks. (**K2**)

Course contents:

Module 1: Basic Internet skills and hardware components

No of. class hours: 5-8 hrs

Learning Outcomes: After completing this module students will be able to:

- 1) Understand browser(**K2**)
- 2) Explore search engines efficiently.(**K2**)
- 3) Understand various computer hardware components (**K2**)

Detail content of the unit:

Basic Internet skills: Understanding browser, efficient use of search engines, awareness about Digital India portals (state and national portals) and college portals

General understanding of various computer hardware components – CPU, Memory, Display, Keyboard, Mouse, HDD and other Peripheral Devices.

Module 2: Operating System Installation and shell commands

No of. Class hours: 6-8 hrs

Learning Outcomes: After completing this module students will be able to:

- 1) Install Operating System (Linux & MS Windows)(**K3**)
- 2) Apply and utilize different Unix Shell and Commands, vi editor (**K2**)

Detail content of the unit:

OS Installation (Linux and MS Windows), Unix Shell and Commands, vi editor.

Module 3: HTML4,CSS and personal webpage design

No of. Class hours: 6-8 hrs

Learning Outcomes: After completing this module students will be able to:

- 1) Understand and apply the basics of HTML4, CSS(**K2**)
- 2) Develop personal webpage(**K3**)

Detail content of the unit:

HTML4, CSS, making basic personal webpage.

Module 4: Office Tools

No of. Class hours: 5-7 hrs

Learning Outcomes: After completing this module students will be able to:

- 1) Understand OpenOffice Writer, OpenOffice Spreadsheet (Calc), OpenOffice Impress.(**K2**)
- 2) Create documents, spreadsheets and presentations(**K3**)

Detail content of the unit:

Office Tools: OpenOffice Writer, OpenOffice Spreadsheet (Calc), OpenOffice Impress.

Module 5: Information security

No of. Class hours:

Learning Outcomes: After completing this module students will be able to:

- 1) Understand different information security aspects(**K2**)
- 2) Analyze various security concepts(**K2**)

Detail content of the unit:

Information security best practices.

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

Fundamentals of Electrical & Electronics Engineering

Course Code	ES 204
Course Title	Elements of Electrical and Electronics Engineering.
Number of Credits	3 (L: 2, T: 1, P: 0)
Prerequisites	NIL
Course Category	Engineering Science

Course Outcomes:

After Completion of the course students would be able to

CO1: Gather knowledge for different passive and active elements like resistors, inductors, capacitors, diode, transistors etc.(Cognitive level K1)

CO2: Analyse Resistive Circuits and Solve different resistive circuits with AC and DC sources.(Cognitive level K4)

CO3: Analyse Single Phase AC Circuits, magnetic circuits and the power in these circuits. (Cognitive level K4)

CO4: To acquire the knowledge about the characteristics and working principles of semiconductor diodes, Bipolar Junction Transistor, FET, MOSFET etc..(Cognitive level K1)

CO5: To apply their knowledge on basics of Digital electronics.(Cognitive level K3)

Unit-I Overview of Active and Passive Components & Signals.

Total class hours-7

Learning Outcomes

After Completion of Unit-1 students would be able to

1. Define different types of active and passive components.(k1)
2. Define A.C & D.C quantities, periodic & nonperiodic signals.(k1)
3. Solve problems on Kirchhoff's voltage and current laws, Star-delta transformations(k3)

Content: Introduction to Passive and Active Components: Resistances, Capacitors, Inductors, Diodes, Transistors, Voltage Source, Current Source, A.C & D.C Signal, periodic/non-periodic signals, Kirchhoff's voltage and current laws, Star-delta transformations – Simple problems on all topics.

Unit-IIA.C. Circuits.

Total class hours-7

Learning Outcomes

After Completion of Unit-II students would be able to

1. Analyze the AC quantities with the help of frequency, Periodic time, RMS value, Average value etc.(k4)
2. Analyze the variables in R-L, R-C and R-L-C series/parallel circuit.(k4)
3. Analyze the power in AC circuits.(k4)

Content: Cycle, Frequency, Periodic time, Amplitude, Angular velocity, RMS value, Average value, Form Factor, Peak Factor, impedance, phase angle, and power factor; Mathematical and phasor representation of alternating emf and current, A.C in resistors, inductors and capacitors; A.C in R-L series, R-C series, R-L-C series and parallel circuits; Power in A. C. Circuits, power triangle, simple numerical on all relevant topics.

Unit-III Electric and Magnetic Circuits.

Total class hours-9

Learning Outcomes

After Completion of Unit-III students would be able to

1. Differentiate between magnetic and electric circuits.(k4)
2. Analyze the different laws of electromagnetic induction.(k4)
3. Relate the different laws of electromagnetic induction in connection with transformer, DC motors and generators. (k4)

Content: EMF, Current, Potential Difference, Power and Energy; M.M.F, magnetic force, permeability, hysteresis loop, reluctance, leakage factor and BH curve; Electromagnetic induction, Faraday's laws of electromagnetic induction, Lenz's law; Dynamically induced emf; Statically induced emf; Equations of self and mutual inductance; Analogy between electric and magnetic circuits. Basic construction, working principle and emf equations of transformer, DC motor and generator, simple numericals on all relevant topics.

Unit-IV Overview of Analog Circuits.

Total class hours-11

Learning Outcomes

After Completion of Unit-IV students would be able to

1. Differentiate various configurations of BJT.(k4)
2. Analyze the differences of operations between BJT and FET.(k4)
3. Apply Op-amp device to design electronic circuits for numerical computations. (k4)

Content: Semiconductor, type, biasing of PN diode, VI characteristics of PN diode, Rectifier-type and operation, Bipolar Junction Transistor-types, operation, configurations, applications, JFET and MOSFET-type, operation, VI characteristics, idea of drain resistances, transconductance, amplification factor, Operational amplifiers- ideal Op-amp, practical Op-amp, open loop and closed loop configurations, design of adder, subtractor, comparator, differentiator and integrator circuits, simple numericals on all relevant topics.

Unit-V Overview of Digital Electronics.

Total class hours-6

Learning Outcomes

After Completion of Unit-V students would be able to

1. Differentiate various logic gates used in digital circuits.(k4)
2. Minimize a logical function using Boolean algebra method.(k4)

Content: Difference between analog and digital operations, Logic levels, Logic gates, Boolean algebra, idea of combinational and sequential circuits, simple numerical on all relevant topics.

References:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Publishing House
2. Mittle 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

Engineering Mechanics

Course Code	:	ES 205
Course Title	:	Engineering Mechanics
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	NIL
Course Category	:	ES

Course outcomes:

After completing this course, student will be able to:

C.O.1: Identify and determine the force systems for given conditions by applying the basics of mechanics (K2).

C.O.2: Determine unknown force(s) of different engineering systems (K3).

C.O.3: Apply the principles of friction in various conditions for useful purposes (K3).

C.O.4: Find the centroid and centre of gravity of various components in engineering systems (K2).

C.O.5: Analyze statically determinate Plane Trusses (K2).

Course Contents:

Unit – I Basics of mechanics and force system

No. of Lectures required: 5-8

Unit Learning Outcomes:

1. Identify flexible body and rigid body; Scalar and vector quantity (K1)
2. Recognize characteristics and effects of a force, Force system and its classification(K1)
3. Explain Orthogonal components and moment of a force(K2)
4. Determine resultant for concurrent, non-concurrent and parallel co-planar force systems(K2)

Contents:

Significance and relevance of Mechanics, Applied mechanics, Statics, Dynamics. Space, time, mass, particle, flexible body and rigid body. Scalar and vector quantity, Units of measurement (SI units) - Fundamental units and derived units.

Force – unit, representation as a vector and by Bow's notation, characteristics and effects of a

force, Principle of transmissibility of force, Force system and its classification.

Resolution of a force - Orthogonal components of a force, moment of a force, Varignon's Theorem.

Composition of forces – Resultant, analytical method for determination of resultant for concurrent, non-concurrent and parallel co-planar force systems – Law of triangle, parallelogram and polygon of forces.

Unit– II Equilibrium

No. of Lectures required: 10-12

Unit Learning Outcomes:

1. Express Conditions of Equilibrium (K2)
2. Identify plane structures and support conditions (K1)
3. Calculate Statically determinate Beam reaction subjected to combination of Point load and uniformly distributed load (K2)
4. Apply graphical methods of analyzing Statically determinate Beam reaction(K3)

Contents:

Equilibrium and Equilibrant, Free body and Free body diagram, Analytical and graphical methods of analysing equilibrium

Lami's Theorem – statement and explanation, Application for various engineering problems. Types of beam, supports (simple, hinged, roller and fixed) and loads acting on beam (vertical and inclined point load, uniformly distributed load, couple),

Beam reaction for cantilever, simply supported beam with or without overhang – subjected to combination of Point load and uniformly distributed load.

Beam reaction graphically for simply supported beam subjected to vertical point loads only.

Unit– III Friction

No. of Lectures required: 5-8

Unit Learning Outcomes:

1. Relate laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose, relation between co-efficient of friction and angle of friction (K1)

2. Apply conditions of Equilibrium of bodies on level surface subjected to force parallel and inclined to plane(K3)
3. Apply conditions of Equilibrium of bodies on inclined plane subjected to force parallel to the plane only (K3)

Contents:

Friction and its relevance in engineering, types and laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose, relation between co-efficient of friction and angle of friction.

Equilibrium of bodies on level surfaces subjected to force parallel and inclined to plane. Equilibrium of bodies on inclined plane subjected to force parallel to the plane only.

Unit– IV Centroid and center of gravity

No. of Lectures required: 8-10

Unit Learning Outcomes:

1. Calculate Centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle)(K2)
2. Determine Centroid of composite figures composed of not more than three geometrical figures (K2)
3. Identify Centre of Gravity of simple Solids (Cube, cuboid, cone, cylinder, sphere, hemisphere) Centre of Gravity of composite solids composed of not more than two simple solids (K2)

Contents:

Centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle)

Centroid of composite figures composed of not more than three geometrical figures

Centre of Gravity of simple solids (Cube, cuboid, cone, cylinder, sphere, hemisphere) Centre of Gravity of composite solids composed of not more than two simple solids.

Unit – V Trusses

No. of Lectures required: 10-12

Unit Learning Outcomes:

1. Describe Static Determinacy, Indeterminacy, and Instability of Plane Trusses(K2)
2. Determine Member forces by Method of joints(K2)
3. Determine Member forces by Method of Section(K2)

Contents:

Assumptions for Analysis of Trusses, Arrangement of Members of Plane Trusses—
Internal Stability,

Equations of Condition for Plane Trusses, Static Determinacy, Indeterminacy, and
Instability of Plane Trusses

Analysis of Plane Trusses by the Method of Joints

Analysis of Plane Trusses by the Method of Sections

Suggested Learning Resources:

1. D.S. Bedi, Engineering Mechanics, Khanna Publications, New Delhi(2008)
2. Khurmi, R.S., Applied Mechanics, S. Chand & Co. New Delhi.
3. Engineering Mechanics, devised by Ural Federal
University <https://www.edx.org/course/engineering-mechanics-2>.
4. Engineering Mechanics, By Prof. K.
Ramesh https://onlinecourses.nptel.ac.in/noc19_me41/preview.
5. Dhade, Jamadar & Walawelkar, Fundamental of Applied Mechanics,
Pune Vidhyarthi Gruh.
6. Ram, H. D.; Chauhan, A. K., Foundations and Applications of
Applied Mechanics, Cambridge University Press.
7. Meriam, J. L., Kraige, L.G., Engineering Mechanics- Statics, Vol. I,
Wiley Publication, New Delhi.

Applied Physics II Lab

Course Code	BS 206
Course Title	Applied Physics-II Lab
Number of Credits	3 (L: 0, T: 0, P: 2)
Prerequisites	Nil
Course Category	Basic Science

Course Outcome:

Students will be able to:-

C.O.1: Illustrate Ohm's law, Kirchoff's law and the laws of reflection & refraction. (K3)

C.O.2: Use lens equations to find focal length and magnifying power of a lens. (K3)

C.O.3: Analyze the conversion of Galvanometer in to ammeter and voltmeter. (K4)

C.O.4: Illustrate V-I Characteristics of semiconductor diode. (K3)

C.O.5: Explain the operation of OHP/ LCD projector. (K2)

List of Practical/Activities: (To perform minimum 6 Practical)

1. To verify laws of reflection from a plane mirror/ interface.
2. To verify laws of refraction (Snell's law) using a glass slab.
3. To determine focal length and magnifying power of a convex lens using optical bench.
4. To verify Ohm's law by plotting graph between current and potential difference.
5. To verify laws of resistances in series and parallel combination.
6. To find the frequency of AC main using electrical vibrator.
7. To verify Kirchoff's law using electric circuits.
8. To convert a galvanometer into an ammeter/ voltmeter.
9. To draw V-I characteristics of a semiconductor diode (Ge, Si) and determine its knee voltage.
10. Study of an optical projection system (OHP/LCD) - project report.

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., 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.

Introduction to IT Systems Lab

Course Code	ES 207
Course Title	Introduction to IT Systems Lab
Number of Credits	2 (L: 0, T: 0, P: 4)
Prerequisites (Course code)	Nil, should be doing ES102 in parallel
Course Category	ES

Course Outcomes:

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

- C.O.1: Comfortably work on Computer **(K2)**
- C.O.2: Install and configure Operating System **(K3)**
- C.O.3: Assemble a PC and connect it to external devices **(K3)**
- C.O.4: Write documents, create worksheets, and prepare presentations **(K2)**
- C.O.5: Protect information and computers from basic abuses/attacks. **(K2)**

Course contents:

Module 1: Basic Internet skills and hardware components

No of. Class hours: 5-8 hrs

Learning Outcomes: After completing this module students will be able to:

- 1) Understand browser **(K2)**
- 2) Explore search engines efficiently. **(K2)**
- 3) Understand various computer hardware components **(K2)**

Detail content of the unit:

- 1. Browser features, browsing, using various search engines, writing search queries
- 2. Visit various e-governance/Digital India portals, understand their features, services offered
- 3. Read Wikipedia pages on computer hardware components, look at those components in lab, identify them, recognize various ports/interfaces and related cables, etc.

Module 2: OS Installation and peripheral connection

No of. Class hours: 6-8 hrs

Learning Outcomes: After completing this module students will be able to:

- 1) Install Operating System (Linux & MS Windows) **(K3)**
- 2) Understand different peripherals & connect them to computer **(K2)**

Detail content of the unit:

1. Install Linux and Windows operating system on identified lab machines, explore various options, do it multiple times
2. Connect various peripherals (printer, scanner, etc.) to computer, explore various features of peripheral and their device driver software.

Module 3: HTML4 and personal webpage design

No of. Class hours: 6-8 hrs

Learning Outcomes: After completing this module students will be able to:

- 1) Understand and apply the basics of HTML4(**K2**)
- 2) Develop personal webpage(**K3**)

Detail content of the unit:

1. Practice HTML commands, try them with various values, make your own Webpage

Module 4: Office Tools

No of. Class hours: 5-7 hrs

Learning Outcomes: After completing this module students will be able to:

- 1) Understand OpenOffice Writer, OpenOffice Spreadsheet (Calc), OpenOffice Impress.(**K2**)
- 2) Create documents, spreadsheets and presentations(**K3**)

Detail content of the unit:

1. Explore features of Open Office tools, create documents using these features, do it multiple times

Module 5: Operating System security features

No of. Class hours: 5-7 hrs

Learning Outcomes: After completing this module students will be able to:

- 1) Understand and different OS security features(**K2**)
- 2) Utilize various OS security features(**K2**)

Detail content of the unit:

1. Explore security features of Operating Systems and Tools, try using them and see what happens.

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. Mastering Linux Shell Scripting: A practical guide to Linux command-line, Bash scripting, and
4. Shell programming, by Mokhtar Ebrahim, Andrew Mallett.
5. IT Essentials PC Hardware and Software Companion Guide, Davis Anfinson and Ken Quamme,
6. CISC Press, Pearson Education.
7. PC Hardware and A+ Handbook, Kate J. Chase PHI (Microsoft).

Fundamental of Electrical and Electronics Engineering Lab

Course Code	EEL 208
Course Title	Fundamentals of Electrical and Electronics Engineering Lab.
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	Engineering Science

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

1. Understand and demonstrate basic principle and operation of electric circuits and machines(K1).
2. Apply their knowledge for solving basic problems related to electrical circuits, magnetic circuits and machines(K3).
3. Identify different active and passive components. (K2)
4. Apply their knowledge to test the performances of diodes.(K3)
5. Analyse voltage, current and power in single phase AC circuits.(K4)

SI No	Name of the Experiment
1	Identify various passive components in the given circuit
2	Identify various active components in the given circuit
3	Determine the value of given resistor using digital multimeter to confirm with colour code.
4	Connect resistors in series and parallel combination on bread board and measure its value using digital multimeter
5	Measure voltage, current and power in 1-phase circuit with resistive load.
6	Measure voltage, current and power in R-L series circuit.
7	Measure voltage, current and power in R-C series circuit.
8	Determine the permeability of magnetic material by plotting its B-H curve
9	Determine the transformation ratio (K) of 1-phase transformer.
10	Test the PN-junction diodes using digital multimeter.
11	Test the performance of LED
12	Identify three terminals of a transistor using digital multimeter.

References:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Publishing House, 2018
2. Mittle 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

Engineering Mechanics Lab

Course Code	:	ES 209
Course Title	:	Engineering Mechanics Lab.
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	NIL
Course Category	:	ES

Course outcomes:

After completing this course, student will be able to:

C.O.1: Identify and determine the force systems for given conditions by applying the basics of mechanics (K2).

C.O.2: Determine unknown force(s) of different engineering systems(K3).

C.O.3: Apply the principles of friction in various conditions for useful purposes (K3).

C.O.4: Find the centroid and centre of gravity of various components in engineering systems (K2).

List of Practical to be performed:

1. To study various equipments related to Engineering Mechanics.
2. To find the M.A., V.R., Efficiency and law of machine for Differential Axle and Wheel.
3. To find the M.A., V.R., Efficiency and law of machine for Simple Screw Jack.
4. Derive Law of machine using Single purchase crab.
5. Derive Law of machine using double purchase crab.
6. Determine resultant of concurrent force system applying Law of Polygon of forces using force table.
7. Determine resultant of concurrent force system graphically.
8. Determine resultant of parallel force system graphically.
9. Verify Lami's theorem.
10. Study forces in various members of Jib crane.
11. Determine support reactions for simply supported beam.
12. Obtain support reactions of beam using graphical method.
13. Determine coefficient of friction for motion on horizontal and inclined plane.
14. Determine centroid of geometrical plane figures.

Suggested Learning Resources:

1. Bedi D.S., Engineering Mechanics, Khanna PublishingHouse
2. Khurmi, R.S., Applied Mechanics, S.Chand & Co. NewDelhi.
3. Bansal R K, A text book of Engineering Mechanics, LaxmiPublications.
4. Ramamrutham, Engineering Mechanics, S.,S Chand & Co. NewDelhi.
5. Dhade, Jamadar &Walawelkar, Fundamental of Applied Mechanics, Pune VidhyarthiGruh.
6. Ram, H. D.; Chauhan, A. K. Foundations and Applications of Applied Mechanics, Cambridge Uni- versityPress.
7. Meriam, J. L., Kraige, L.G. , Engineering Mechanics- Statics, Vol. I, Wiley Publication, NewDelhi.

Environmental Science

Course Code	AU 210
Course Title	Environmental Science
Number of Credits	0 (non-credit) (L:2, T:0, P:0)
Prerequisites	High School Science
Course Category	Audit

Course outcomes:

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

C.O.1: Know the ecosystem and terminology and solve various engineering problems applying ecosystem knowledge to produce eco – friendly products. (**K₁ and K₃**)

C.O.2: Identify the factors of air and noise pollution, and know the acts and the control measures. (**K₁ and K₂**)

C.O.3: Explain the water and soil pollution, and know the acts and the control measures. (**K₁ and K₂**)

C.O.4: Illustrate different renewable energy resources and efficient process of harvesting. (**K₃**)

C.O.5: Describe solid Waste Management, ISO 14000 & Environmental Management (**K₂**)

Course Content:

Unit-1: Ecosystem

Number of class Hours:- 6

Learning outcomes:

At the end of the unit- 1 student will be able to

1. Know the structure of ecosystem and various components (**K₁**)
2. Know Carbon, Nitrogen, Sulphur, Phosphorus cycle (**K₁**)
3. Solve various issues like Global warming, Green House Effect etc. (**K₃**)

Content:-

Structure of ecosystem, Biotic & Abiotic components

Food chain and food web

Aquatic (Lentic and Lotic) and terrestrial ecosystem

Carbon, Nitrogen, Sulphur, Phosphorus cycle.

Global warming -Causes, effects, process, Green House Effect, Ozone depletion

Unit– 2 Air and, Noise Pollution

Number of class Hours:-6

Learning outcomes:

At the end of the unit- 2 students will be able to

1. Know about air and noise pollution, effect and control of air and noise pollution (**K₁**)
2. Identify the factors air and noise pollution (**K₂**)

Content:-

Definition of pollution and pollutant, Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler)

Air Pollutants: Types, Particulate Pollutants: Effects and control (Bag filter, Cyclone separator, Electrostatic Precipitator)

Gaseous Pollution Control: Absorber, Catalytic Converter, Effects of air pollution due to Refrigerants, I.C., Boiler

Noise pollution: sources of pollution, measurement of pollution level, Effects of Noise pollution, Noise pollution (Regulation and Control) Rules, 2000

Unit- 3 Water and Soil Pollution

Number of class Hours:-6

Learning outcomes:

At the end of the unit- 3 students will be able to

1. Know about water and soil pollution, effect and control of air and noise pollution (**K₁**)
2. Explain the water and waste treatment process (**K₂**)
3. Explain the preventive measures of soil pollution (**K₂**)

Content:-

Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD: Definition, calculation Waste Water Treatment: Primary methods: sedimentation, froth floatation, Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method: Membrane separation technology, RO (reverse osmosis).

Causes, Effects and Preventive measures of Soil Pollution: Causes-Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-Waste.

Unit- 4 Renewable sources of Energy

Number of class Hours:-6

Learning outcomes:

At the end of the unit- 4 students will be able to

1. Know about solar energy, Hydrogen energy, Ocean energy resources and Tidal energy conversion (**K₁**)
2. Illustrate the production and utilization of biomass (**K₃**)
3. Illustrate the benefits of wind energy (**K₃**)

Content:-

Solar Energy: Basics of Solar energy. Flat plate collector (Liquid & Air). Theory of flat plate collector. Importance of coating. Advanced collector. Solar pond. Solar water heater, solar dryer. Solar stills.

Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel. Anaerobic digestion. Biogas production mechanism. Utilization and storage of biogas.

Wind energy: Current status and future prospects of wind energy. Wind energy in India. Environmental benefits and problem of wind energy.

New Energy Sources: Need of new sources. Different types new energy sources. Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion.) Concept, origin and power plants of geothermal energy

Unit-5 Solid Waste Management, ISO 14000 & Environmental Management**Number of class Hours:-6****Learning outcomes**

At the end of the unit- 5 students will be able to

1. Know about solid waste, E-waste and bio-medical waste (**K₁**)
2. Describe about solid waste management and various environmental act (**K₂**)

Content:-

Solid waste generation- Sources and characteristics of: Municipal solid waste, E- waste, biomedical waste.

Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries.

Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous Waste.

Air quality act 2004, air pollution control act 1981 and water pollution and control act 1996.

Structure and role of Central and state pollution control board.

Concept of Carbon Credit, Carbon Footprint.

Environmental management in fabrication industry.

ISO14000: Implementation in industries, Benefits.

References:**(a) Suggested Learning Resources:****Books:**

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
4. 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)
