

KHATAI INSTITUTE OF ENGINEERING & TECHNOLOGY, BERHAMPUR

(Approved by AICTE | Affiliated to SCTE & VT, Odisha)

ACADEMIC YEAR 2026 -27

SYLLABUS FOR

1ST YEAR DIPLOMA ENGINEERING



**STATE COUNCIL FOR TECHNICAL EDUCATION &
VOCATIONAL TRAINING NEAR RAJ BHAWAN, UNIT-VIII,
BHUBANESWAR, ODISHA.**



1ST YEAR NEW SYLLABUS W.E.F. 2026-27

SL No	PAPER	CODE	Course Title	Teaching Scheme		Evaluation Scheme				Total Marks	Credits
				Contact Hours/ week		Theory		Practical			
				L	P	End Exam	Progressive Assessment	End Exam	Progressive Assessment		
1	THEORY PAPERS	TH-1	Communication Skills in English	2		70	30			100	2
2		TH-2	Applied Physics	4		70	30			100	4
3		TH-3	Applied Chemistry & Environmental Science	4		70	30			100	4
4		TH-4	Mathematics	4		70	30			100	4
5		TH-5	Fundamentals of Computing & Artificial Intelligence	2		70	30			100	2
6		TH-6	Fundamentals of Electrical & Electronics Engineering	2		70	30			100	2
7		TH-7	Engineering Mechanics	2		70	30			100	2
1	PRACTICAL PAPERS	PR-1	Communication Skills in English Lab		2			25	25	50	1
2		PR-2	Applied Physics Lab		2			25	25	50	1
3		PR-3	Applied Chemistry Lab		2			25	25	50	1
4		PR-4	Computing & AI Lab.		2			25	25	50	1
5		PR-5	Engineering Workshop Practice		2			50	50	100	1
6		PR-6	Engineering Graphics		2			50	50	100	1
7		PR-7	Fundamentals of Electrical & Electronics Engineering Lab		2			-	25	25	1
8		PR-8	Engineering Mechanics Lab		2			-	25	25	1
9		PR-9	Sports and Yoga		2			-	50	50	1
			TOTAL	20	18	490	210	200	300	1200	29

* The average of the best two internals out of 3 internals conducted will be taken as final IA marks for the student. Assignment/ quiz etc. of 10 marks to be treated as part of IA. Besides this, Monthly Test to be conducted for each subject. Sessional Marks shall be total of the performance of individual different jobs/ experiments in a subject throughout the year. Addon Skills/ Club/Innovation/ Idea Tinkering Activities etc. shall be encouraged to be performed by students beyond the above stipulated hours and the hours after completion of the contact hours mentioned in Practical-9 i.e. Sports & Yoga in 1st Phase of Academic Year.

COMMUNICATION SKILLS IN ENGLISH (YEARLY PATTERN)

Course Code- TH 1(Common to all Branches)

Period per week:	02	Progressive Assessment:	30 Marks
Total Period:	64	End Examination:	70 Marks
Duration of End Exam.	03 Hours	Credit:	02

Course outcomes:

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

- Analyse and implement the meaning, process of communication, types of communication and overcome the barriers and be able to communicate effectively both in professional and interpersonal contexts.
- Comprehend soft skill and hard skill and to apply it in day-to-day life.
- Comprehend the seen passages and develop basic speaking and writing skills including proper usage of language and vocabulary so that they can become highly confident and skilled speakers and writers.
- Write personal, business letter, draft notices and job application with CV.
- Enhance vocabulary and apply English grammar rules correctly while framing a sentence and write letters, application etc. in proper format

Course Content

Unit-1 Communication: Theory and Practice

(12 Hours)

- 1.1 Basics of communication: Meaning and Definition
- 1.2 Process of communication and communication model
- 1.3 Types of communication: formal (upward, downward and parallel/horizontal) and informal (grapevine), verbal (meaning and definition), non-verbal (proxemics, kinesics and paralanguage)
- 1.4 Barriers to effective communication (semantics, psychological, physical and cultural)
- 1.5 7 Cs for effective communication (considerate, concrete, concise, clear, complete, correct, courteous)
- 1.6 Art of Effective communication
 - Choosing words
 - Voice
 - Modulation
 - Clarity
 - Time
 - Simplification of words
- 1.7 Technical Communication (Definition and features)

Unit-2 Soft Skills for Professional Excellence

(08 Hours)

- 2.1 Introduction: Soft Skills and Hard Skills
- 2.2 Importance of Soft Skills
- 2.3 Life Skills: Self-awareness and Self-analysis
- 2.4 Applying Soft Skills across cultures

Unit-3: Reading Comprehension

(20 hours)

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

3.1 Section-1 (Prose)

Excerpts from *Malgudi Days* by R.K. Narayan:

3.1.1 "An Astrologer's Day",

3.1.2 "The Missing Mail",

3.1.3 "Doctor's Word"

3.1.4 "The Gift of the Magi" by O. Henry

3.2 Section-2(Poems)

3.2.1 "Stopping by Woods on a Snowy Evening" by Robert Frost,

3.2.2 "Where the Mind is Without Fear" by Rabindranath Tagore

3.2.3 "Daffodils" by William Wordsworth

3.2.4 "To My True Friend" by Elizabeth Pinard

Unit-4: Professional Writing

(12 hours)

4.1 Summary writing

4.2 Report writing (Annual Function, Blood Donation Camp, Poly-fest, Road Accident)

4.3 Applications- Principal, Hostel Superintendent, HOD, Librarian

4.4 Letters:

4.4.1 Personal Letters: parents, brother/sister, friend.

4.4.2 Business Letters-Letter of Enquiry, Placing an order, complaint and cancellation

4.5 Drafting e-mail- Bank manager to open an account. Congratulating a friend on his/her achievement

4.6 Notice Writing: competitions, inviting articles for magazines, study tour, lost/found items

4.7 CV/Resume'

Unit-5: Vocabulary and Grammar

(12 hours)

5.1 Vocabulary of commonly used words

5.2 Commonly used administrative terms (English only)

5.3 One-word substitution

5.4 Parts of Speech

5.5 Concord

5.6 Tenses

5.7 Voice-change

5.8 Punctuation

Portions for Internal Assessment.

1. Portion for 1st Internal Assessment -Unit 1 & Unit 5

2. Portion for 2nd Internal Assessment -Unit 2 & Unit 3

3. Portion for 3rd Internal Assessment -Unit 4 & Unit 5

Portions for End Examination:

Unit-1

Unit-3

Unit-4

Unit-5

References:

1. M. Ashraf Rizvi. *Effective Technical Communication*. Mc-Graw Hill, 2002.
2. John Nielson. *Effective Communication Skills*. Xlibris, 2008.
3. *Roget's Thesaurus of English Words and Phrases*
4. Wren & Martin. *High School English Grammar and Composition*. S Chand, 2024
5. A. J. Thomson & A. V. Martinet. *Practical English Grammar*. Oxford University Press, 1997
6. R.K.Narayan. *Malgudi Days*. Indian Thought Publications, 2017
7. Sanjay.Kumar&Pushp.Lata. *Communication Skills*. Oxford University Press, 2024.
8. Invitation to English-1 (CHSE, Odisha)

APPLIED PHYSICS

Course Code- TH 2

Period per week:	4	Progressive Assessment:	30 Marks
Total Period:	128	End Exam:	70 Marks
Duration of End Exam.	3 Hours	No. of Credit:	4

Course Outcomes (COs)

CO1: Apply the concepts of physical quantities, units, dimensions, measurement techniques, and error analysis to solve engineering and scientific problems accurately.

CO2: Analyze the principles of mechanics including force, friction, work, power, energy, circular motion, rotational motion, and conservation laws in practical engineering applications.

CO3: Explain and evaluate the properties of matter, elasticity, fluid mechanics, wave motion, oscillations, sound, and thermal phenomena relevant to engineering systems.

CO4: Apply the laws of geometrical optics and optical instruments to analyze image formation, optical fibers, and related technological applications.

CO5: Analyze electrostatic and electrical circuits using concepts of electric fields, capacitors, current electricity, electromagnetic induction, magnetic effects of current, and electrical measuring instruments.

CO6: Explain the principles of semiconductor devices, p-n junctions, rectifiers, lasers, and modern physics concepts, and relate them to engineering and technological applications.

Course Content:

Unit 1: Physical world, Units and Measurements

[10 periods]

- 1.1 Physical quantities: fundamental and derived, Units and systems of units (FPS, CGS and SI units),
- 1.2 Dimensions and dimensional formulae of physical quantities such as velocity, acceleration, force, linear momentum, kinetic energy, potential energy, work, power, pressure and density, 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.
- 1.3 Errors in measurements (systematic and random), absolute error, relative error, error propagation, error estimation and significant figures.

Unit 2: Force and Friction

[10 periods]

- 2.1 Scalar and Vector quantities – examples, representation of vector, types of vectors. Addition and Subtraction of Vectors, Triangle and Parallelogram law (Statement only), Scalar and Vector Product, Resolution of a Vector.
- 2.2 Newton's Laws of Motion, Force, Momentum, Statement and derivation of conservation of linear momentum, its applications such as recoil of gun, rockets, Impulse and its applications.
- 2.3 Friction: concept, types of Friction, laws of limiting friction, coefficient of friction, Angle of Friction, Angle of Repose, Methods of reducing friction and its engineering applications.

Unit 3: Work, Power, Energy

[10 periods]

- 3.1 Work: Concept and units, examples of zero work, positive work and negative work Energy and its units, kinetic energy, Work-Energy Theorem (Concepts only) gravitational potential energy with examples and derivations, mechanical energy, conservation of mechanical energy for freely falling bodies.
- 3.2 Power and its units, power and work relationship, calculation of power (numerical problems).

Unit 4: Circular & Rotational Motion

[12 periods]

- 4.1 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(without Friction) and bending of cyclist.

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

4.3 Moment of inertia and its physical significance, radius of gyration for rigid body, Theorems of parallel and perpendicular axes (statements only), Moment of inertia of rod, disc, ring and sphere (hollow and solid); (Formulae only).

Unit 5: Properties of Matter

[12 periods]

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

5.2 Pressure: definition, units, atmospheric pressure, gauge pressure, absolute pressure

5.3 Surface tension: concept, units, cohesive and adhesive forces, angle of contact, applications of surface tension.

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

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

Unit-6: Waves and Oscillations

[12 periods]

6.1 Periodic Motion, Oscillatory Motion, Simple Harmonic Motion (SHM): definition, expression for displacement, velocity, acceleration, time period, frequency, Total Energy of a particle executing SHM, Free, forced and resonant vibrations with examples.

6.2 Wave motion, transverse and longitudinal waves with examples, definitions of wave velocity, frequency and wave length and their relationship, wave equation, amplitude, phase, phase difference, principle of superposition of waves.

6.3 Characteristics of Sound Wave (Intensity, Loudness, Pitch & Quality), Reverberation, reverberation time, echo (Concepts only), Ultrasonic waves—Introduction and properties, engineering and medical applications of ultrasonic.

Unit 7: Thermal Physics

[10 periods]

7.1 Concept of heat and temperature, specific heats, Thermal Capacity, Latent Heat, Principle of Heat with numerical, scales of temperature and their relationships

7.2 Expansion of solids, coefficient of linear, superficial and cubical expansions of solids and relation among them.

7.3 Modes of heat transfer (conduction, convection and radiation with examples), Co-efficient of thermal conductivity, engineering applications.

Unit-8: Optics

[10 periods]

8.1 Laws of reflection, Laws of refraction, refractive index, Image formation by spherical mirrors, Mirror Formula with numerical, Image formation by Lens, Lens formula with numerical, Power of lens, magnification of Lens.

8.2 Critical angle, Total internal reflection, applications of total internal reflection, Optical fiber applications in: telecommunication, medical and sensors.

8.3 Optical Instrument: Simple Microscope and its magnifying Power

UNIT-9: Electrostatics

[10 periods]

9.1 Coulomb's 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.

9.2 Capacitance and its units. Capacitance of a Spherical conductor, parallel plate capacitor, dielectric and its effect on capacitance Series and parallel combination of capacitors (related numerical).

Unit-10: Current Electricity

[10 periods]

10.1 Electric Current and its units, Drift Velocity and expression of Current in terms of drift Velocity, Direct and alternating current, Resistance and its units, Specific resistance, Conductance, Specific conductance, Series and parallel combination of resistances. Effect of Temperature on Resistance.

10.2 Ohm's law and its verification, Concept of terminal potential difference, Electromotive force (EMF) & Internal Resistance of Cell., Kirchhoff's laws, Wheatstone bridge (Balanced Condition)

10.3 Joule's Law of heating effect of current, Electric power, Electric energy and its units (related numerical problems).

Unit-11: Magnetic Effect of Current & Electromagnetism

[12 periods]

11.1 Coulomb's Law in Magnetism, Magnetic field and its units, magnetic intensity, magnetic lines of force and its properties, magnetic flux and units, Intensity of magnetization, Types of magnetic materials: dia, para and ferromagnetic with their properties,

11.2 Biota-Savart's Law, Magnetic Field due to Infinite straight conductor and at the Centre of a circular coil carrying current (Formula Only), Force on moving charge in magnetic field, Force on current carrying conductor placed in a magnetic Field, Concept of electromagnetic induction, Faraday's Laws of Electromagnetic Induction, Lenz's Law (Statement only)

11.3 Moving coil galvanometer (principle only), Conversion of a galvanometer into ammeter and voltmeter.

Unit-12: Semiconductor & Modern Physics

[10 periods]

12.1 Energy bands in solids- Distinguish between conductor, semi-conductor & insulator on the basis of Band Theory, Intrinsic and extrinsic semiconductors, Effect of Temperature on resistivity of a Semiconductor (Concept only), p-n junction, junction diode and V-I characteristics, Diode as rectifier – half wave and full wave rectifier (centre taped).

12.2 LASER and its Properties, spontaneous and stimulated emission, population inversion, optical pumping, engineering and medical applications of lasers.

N.B.

Portion For 1st Internal Assessment

Unit-1, Unit-2, Unit-3

Portion For 2nd Internal Assessment

Unit-4, Unit-5, Unit-6, Unit-7

Portion For 3rd Internal Assessment

Unit-8, Unit-9, Unit-10, Unit-11 & Unit-12

Portion for End Examination

Unit-8, Unit-9, Unit-10, Unit-11 & Unit-12

References :

1. Applied Physics-I& II by Prof.Vinod Kumar Yadav(Download from <https://ekumbh.aicte-india.org/dbook.php>)
2. Text Book of Applied Physics I & II: KN Sharma, Dr. B. Mohanty, Debasish Das (Kalyani Publishers).
3. Text Book of Physics for Class XI & XII(Part-I,Part-II);N.C.E.R.T.,Delhi
4. Concepts in Physics by HC Verma, Vol.I & II,Bharti Bhawan Ltd. New Delhi
5. Practical Physics by C.L. Arora, S.Chand Publication.

APPLIED CHEMISTRY AND ENVIRONMENTAL SCIENCE

Course Code – TH 3

Period per Week	4	Progressive Assessment:	30 Marks
Total Periods	128	Final Exam:	70 Marks
Duration of End Exam.	3 Hours	No. of Credits:	4

CO-I Analyze real life problems associated with various environmental pollution, effects and controlling measures and to mitigate with solid wastes.

CO- II Solve the engineering problems using concepts of electrochemistry, corrosion, fuel and lubricant for domestic and industrial applications.

CO-III Solve various engineering problems applying the basic concepts of atomic structure, chemical bonding and solutions.

CO-IV Use relevant water treatment method to solve domestic and industrial problems.

CO-V Solve the engineering problems using concepts of engineering materials and properties.

CO-VI Understand ecosystem and harnessing renewable energy from various sources.

CO	For Internal-1,2	CO	For internal-3 and Final Exam.
I	Unit-1 Air and noise pollution	III	Unit-6 Atomic structure, chemical bonding and solution
	Unit-2 Water and soil pollution	IV	Unit-7 Water and Water Treatment
	Unit-3 Solid waste Management	V	Unit-8 Engineering Materials
II	Unit-4 Electrochemistry and Corrosion	VI	Unit-9 Eco system
	Unit-5 Fuels and Lubricants		Unit-10 Renewable sources of energy

UNIT-1: Air and Noise Pollution (10 Periods)

1.1 Definition of pollution and pollutant, classification of pollutant (primary and secondary), Natural and man-made sources of air pollution.

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

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

1.4 Noise pollution: Definition, sources of pollution, Effects and control of Noise Pollution.

UNIT-2: Water and Soil Pollution (12 Periods)

2.1 Sources of water pollution, Types of water pollutants,

2.2 Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD,

2.3 Waste Water Treatment: Primary methods: sedimentation, froth floatation, Secondary methods, Activated sludge treatment, Bioreactor, Tertiary Method: Membrane separation technology, RO (reverse osmosis).

2.4 Soil Pollution: Definition, Causes, Effects and Preventive measures of Soil Pollution

2.5 Effects of Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-Waste on soil pollution.

UNIT-3: Solid Waste Management (10 Periods)

3.0 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.

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

3.2 Concept of Carbon Credit, Carbon Footprint.

3.3 Environmental management in fabrication industry.

UNIT-4: Electrochemistry & Corrosion (16 Periods)

4.1 Electronic concept of oxidation, reduction and redox reactions.

4.2 Definition of terms: electrolytes, non-electrolytes with suitable examples,

4.3 Faradays laws of electrolysis and simple numerical problems.

4.4 Industrial Application of Electrolysis –Electrometallurgy, Electroplating, Electrolytic refining.

4.5 Application of redox reactions in electrochemical cells – Primary cells – dry cell, Secondary cell - commercially used lead storage battery and fuel cells.

4.6 Introduction to Corrosion of metals - definition, types of corrosion (chemical and electrochemical), H_2 liberation and O_2 absorption mechanism of electrochemical corrosion, factors affecting rate of corrosion.

4.7 Internal corrosion preventive measures –Purification, alloying and heat treatment and External corrosion preventive measures: a) metal (anodic, cathodic) coatings, b) organic inhibitors.

UNIT-5: Chemistry of Fuels and Lubricants (14 Periods)

5.1 Definition of fuel, classification of fuels, calorific values (HCV and LCV),

5.2 Liquid fuels petrol and diesel - fuel rating (octane and cetane numbers),

5.3 Chemical composition, calorific values and applications of LPG, CNG, water gas, coal gas, producer gas and biogas.

5.4 Lubricant – Definition, function, classification with examples,

5.5 Lubrication definition and mechanism (hydrodynamic and boundary lubrication)

5.6 Physical properties (viscosity and viscosity index, oiliness, flash and fire point, cloud and pour point only) and chemical properties (coke number, total acid number saponification value) of lubricants, characteristic properties of good lubricant.

UNIT-6: Atomic Structure, Chemical Bonding and Solutions (21 Periods)

6.1 Rutherford model of atom and its failures,

6.2 Bohr's theory (expression of energy and radius to be omitted), and hydrogen spectrum explanation based on Bohr's model of atom,

6.3 Quantum numbers – orbital concept. Shapes of s, p and d orbitals,

6.4 Pauli's exclusion principle, Heisenberg uncertainty principle, Aufbau principle, electronic configurations (up to atomic number 30). Hund's rule of maximum multiplicity.

6.5 Concept of chemical bonding – cause of chemical bonding, types of bonds: ionic bonding (NaCl example), covalent bond (H_2 , F_2 , HF),

6.6 Basic concept of orbital overlapping sigma and pi bonds, Concept of hybridization, hybridization in $BeCl_2$, BF_3 , CH_4 , NH_3 , H_2O),

6.7 Coordination bond in NH_4^+ ion, metallic bonding.

6.8 Hydrogen bond and anomalous properties of NH_3 , H_2O due to hydrogen bonding,

6.9 Solution – idea of solute, solvent and solution, methods to express the concentration of solution normality, molarity, molality, ppm, mass percentage, volume percentage and mole fraction. (with Simple numerical)

UNIT-7: Water and Water Treatment (13 Periods)

7.1 Graphical presentation of water distribution on Earth (pie or bar diagram). Classification as soft and hard water,

7.2 Causes of hardness, unit of hardness and simple numerical on water hardness and conversion. 7.3 Cause of poor lathering of soap in hard water, problems caused by the use of hard water in boiler (scale and sludge, foaming and priming, corrosion etc.),

7.4 Quantitative measurement of water hardness by EDTA method, total dissolved solids (TDS) alkalinity estimation.

7.5 Water softening techniques – soda lime process, zeolite process and ion exchange process.

7.6 Municipal water treatment (in brief only) – sedimentation, coagulation, filtration, sterilization.

UNIT-8: Engineering Materials (11 Periods)

8.1 Natural occurrence of metals – minerals, ores of iron, aluminium and copper, gangue (matrix) flux, slag,

8.2 Metallurgy – brief account of general principles of metallurgy.

8.3 Alloys – definition, purposes of alloying, ferrous alloys and nonferrous with suitable examples properties and applications of Brass, Bronze, Stainless Steel, Alnico, Duralumin.

8.4 Polymers – monomer, homo and co polymers, degree of polymerization, addition polymerization and condensation polymerization,

8.5 Simple reactions involved in preparation and their application of thermoplastics and thermosetting plastics (using PVC, PS, PTFE, nylon – 6, nylon-6,6 and Bakelite),

8.6 Rubber and vulcanization of rubber. Advantages of vulcanized rubber over natural rubber.

UNIT-9: Ecosystem (8 Periods)

9.1 Structure of ecosystem, Biotic & Abiotic components Food chain and food web,

9.2 Aquatic (Lentic and Lotic) and terrestrial ecosystem (grassland, forest, desert),

9.3 Carbon, Nitrogen, Sulphur, Phosphorus cycle.

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

UNIT-10: Renewable sources of Energy (13 Periods)

10.1 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.

10.2 Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel. 10.3 Anaerobic digestion. Biogas production mechanism and Utilization.

10.4 Wind energy: Future prospects of wind energy. Wind energy in India. Environmental benefits and problem of wind energy.

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

Portions for 1st Internal Assessment - unit 1, unit 2 and Unit 3

Portion for 2nd Internal Assessment - unit 4 and Unit 5.

Portion for 3rd Internal assessment – Unit 6 to unit 10

Portion for End Examination - Unit 6 to unit 10

References:

(A) Suggested Learning Resources for Applied Chemistry part:

(a) Books:

1. Applied Chemistry by Dr. Anju Rawley (Download from <https://ekumbh.aicteindia.org/dbook.php>)
2. Text Book of Chemistry for Class XI& XII(Part-I, Part-II); N.C.E.R.T., Delhi, 2017-18.
3. Agarwal, & Shikha, Engineering Chemistry, Cambridge University Press; New Delhi, 2015.
4. C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.
5. Dara, S.S. & Dr. S.S. Umare, Engineering Chemistry, S. Chand. Publication, New Delhi, New Delhi, 2015.
6. Jain & Jain, Engineering Chemistry, Dhanpat Rai and Sons; New Delhi, 2015.
7. Dr. Vairam, S., Engineering Chemistry, Wiley India Pvt. Ltd., New Delhi, 2013.
8. Dr. G. H. Hugar & Prof A. N. Pathak, Applied Chemistry Laboratory Practices, Vol. I and Vol. II, NITTTTR, Chandigarh, Publications, 2013-14.
9. Agnihotri, Rajesh, Chemistry for Engineers, Wiley India Pvt. Ltd., 2014.

(b) Open-source software and website address:

- 1 www.chemguide.co.uk/atommenu.html (Atomic structure and chemical bonding)
- 2 www.visionlearning.com (Atomic structure and chemical bonding)
- 3 www.chem1.com (Atomic structure and chemical bonding)
- 4 <https://www.wastewaterelearning.com/elearning/> (Water Treatment)
- 5 www.capital-refractories.com (Metals, Alloys, Cement, and Refractory Materials)

(B) Suggested Learning Resources for Environmental Science part:

(a) Books:

1. Environmental Science (English) by Dr. Subrat Roy (Download from <https://ekumbh.aicte-india.org/dbook.php>)
2. S.C. Sharma & M.P. Poonia, Environmental Studies, Khanna Publishing House, New Delhi
3. C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.
4. Arceivala, Soli Asolekar, Shyam, Waste Water Treatment for Pollution Control and Reuse, Mc-Graw Hill Education India Pvt. Ltd., New York, 2007, ISBN:978-07-062099-
5. Nazaroff, William, Cohen, Lisa, Environmental Engineering Science, Willy, 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)

(b) Open-source software and website address:

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

MATHEMATICS

Course Code- TH-4

Period per week	4	Progressive Assessment:	30 marks
Total Period	128	End Sem Exam	70
Duration of End Exam.	3 Hours	No of credits	4

Course outcomes: -

CO₁- Apply Trigonometry and co-ordinate geometry for the calculation and the mathematical analysis of engineering problems.

CO₂- Apply the concepts and techniques of complex numbers, partial fraction decomposition, permutations, combinations and the binomial theorem to analyze, simplify, and solve algebraic, combinatorial and mathematical problems efficiently.

CO₃- Apply the concepts and operations of matrices and determinants to solve systems of linear equations and analyse mathematical problems arising in science and engineering.

CO₄- Apply vector operations to determine projections and angles between vectors, and applying dot and cross products to solve geometric and engineering-related problems in two and three dimensions.

CO₅- Apply the concepts of limit to analyse the behaviour of functions, determine continuity, differentiability and solve mathematical and real-world problems involving rates of change and optimization.

CO₆- Apply the principles of integral calculus and differential equations to evaluate integrals, determine area under a plane curve, formulate mathematical models and solve first-order differential equations arising in scientific and engineering applications.

Course Outcomes	Unit	Topic
CO₁	1 and 2	Trigonometry and Co-ordinate Geometry
CO₂	3 (3.1, 3.2 and 3.3)	Complex number, Partial fraction, Permutation, Combination and Binomial theorem.
CO₃	3(3.4)	Determinant and matrices
CO₄	4	Vector Algebra
CO₅	5	Limit, Continuity and Derivative.
CO₆	6	Integral Calculus and Differential Equation.

Course Content: -

Unit-1-

Trigonometry (16 hours)

- 1.1 Concept of angles, measurement of angles in degrees, grades and radians and their Conversions.
- 1.2 T-Ratios of Allied angles (without proof), Sum, difference, Product formulae, Transformation of product to sum, difference and vice versa (without proof) and their applications.
- 1.3 T- Ratios of multiple angles (2A, 3A) and sub-multiple angles (A/2).
- 1.4 Introduction to Inverse Trigonometric functions and their properties (without Proof).

Unit-2-

Co-Ordinate Geometry (14 hours)

- 2.1 Introduction to Co-ordinate Geometry. Distance formula, Section formula.
- 2.2 Slope of a line. Relationship between slope of perpendicular and parallel lines.
- 2.3 Equation of straight line in various standard forms (without proof).
- 2.4 Inter section of two straight lines and angle between two lines.
- 2.5 Perpendicular distance from a given point to a line.
- 2.6 Centre and radius of a Circle. General equation of a circle .
- 2.7 Equation of a circle Passing through three given points.
- 2.8 Equation of circle when two end points of a diameter are given.

Unit-3

3.1 Complex Numbers (12 hours)

- 3.1.1 Definition of complex number. Real and imaginary parts of a Complex number.
- 3.1.2 Polar and Cartesian representation of a complex number and its conversion from one form to other.
- 3.1.3. Conjugate of a complex number, Modulus and Amplitude of a complex number.
- 3.1.4. Addition, Subtraction, Multiplication and Division of a complex number.
- 3.1.5 Square root of a complex number.
- 3.1.6 Cube roots of unity.
- 3.1.7 De-moivre's theorem (statement only) and its simple applications.

3.2 Partial fractions (4 hours)

- 3.2.1 Definition of Polynomial, Proper & Improper fractions, Definition of partial fractions.
- 3.2.2 Resolve proper fraction into partial fractions with denominator containing non-repeated linear factors.
- 3.2.3 Resolve proper fraction into partial fractions with denominator containing repeated linear factors.
- 3.2.4 Resolve proper fraction into partial fractions with denominator containing non-repeated irreducible quadratic factors.

3.3 Permutations and Combinations and Binomial theorem (6 hours)

- 3.3.1 Factorial of a non-negative integer.
- 3.3.2 Determine $P(n, r)$ and $C(n, r)$.
- 3.3.3 Binomial theorem (without proof) for positive integral index.
- 3.3.4 Determination of general term and Middle term in binomial expansion.

3.4 Determinants and Matrices (16 hours)

- 3.4.1 Introduction to matrices. Order of a matrix. Types of matrices.
- 3.4.2 Addition, Subtraction, Scalar multiplication and multiplication of matrices.
- 3.4.3 Introduction to determinant. Expansion of determinant up to 3rd order.
- 3.4.4 Properties of determinants.
- 3.4.5 Minors and Co-factors. Inverse of a matrix.
- 3.4.6 Solution of system of linear equations by Crammer's rule up to 3 variables.
- 3.4.7 Solution of system of linear equations by matrix method up to 3 variables.

Unit-4

Vector Algebra (12 hours)

- 4.1 Vector and Scalar Quantities.
- 4.2 Notation and rectangular resolution of a vector.
- 4.3 Types of vectors.
- 4.4 Addition, subtraction and scalar multiplication of vectors.
- 4.5 Scalar and vector products of two vectors.
- 4.6 Angle between two vectors
- 4.7 Scalar and Vector projection of a vector on another vector.
- 4.8 Area of a triangle and Area of a parallelogram.
- 4.9 Simple problems related to work and moment of a force.

Unit-5

5.1 Limits and Continuity (8 hours)

- 5.1.1 Define function.
- 5.1.2 Types of functions
 - Constant function
 - Identity function
 - Absolute value function
 - The Greatest integer functions
 - Trigonometric function
 - Exponential function
 - Logarithmic function
- 5.1.3 Define limit of a function and Existence of limit of a function.
- 5.1.4 Algebra of limits.
- 5.1.5 Limit of some standard functions (without proof)

- $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a}$
- $\lim_{x \rightarrow 0} \frac{\sin x}{x}$
- $\lim_{x \rightarrow 0} \frac{a^x - 1}{x}$

$$\lim_{x \rightarrow 0} (1+x)^{\frac{1}{x}}$$

5.1.6 Limit of $|x|$ and $[x]$.

5.1.7 Evaluation of limits using standard formulas

5.1.8 Test of Continuity of a function at a point.

5.2 Differentiation (10 hours)

5.2.1 Differentiation of algebraic functions, exponential function, logarithmic function, trigonometric and inverse trigonometric functions (without proof).

5.2.2 Differentiation of sum, product and quotient of functions.

5.2.3 Differentiation of function of a function (Chain Rule).

5.2.4 Differentiation using logarithm.

5.2.5 Differentiation of a function w.r.t another function.

Unit-6

6.1 Integral Calculus (18 hours)

6.1.1 Integration as inverse process of differentiation.

6.1.2 Simple integration by substitution.

6.1.3 Integration by parts.

6.1.4 Integration using partial fractions (for linear factors only).

6.1.5 Definite integrals of some simple functions

6.1.6 Properties of definite integrals (without proof).

6.1.7 Simple problem on evaluation of area bounded by a curve and axes.

6.2 Differential Equation (12 hours)

6.2.1 Introduction to Differential Equation. Order and degree of a differential equation.

6.2.2 Formation of differential equation.

6.2.3 Solution of first order and first-degree differential equation by variable separable method.

6.2.4 Solution of linear differential equations.

Portion for Internal Assessments and End Examination

Examination	Unit	Topics
1 st Internal	1,2 and 3(3.1 and 3.2).	Trigonometry, Co-ordinate Geometry, Complex Numbers and Partial Fraction.
2 nd Internal	3(3.3 and 3.4), 4 and 5 (5.1)	Permutation, Combination, Binomial theorem, Determinant, Matrices, Vector algebra, Limit and Continuity
3 rd Internal	5 (5.2) and 6	Differentiation, Integral Calculus and Differential Equation.
End Exam	3(3.4), 4, 5 (5.2) and 6.	Determinant and Matrices, Vector Algebra, Differentiation, Integral Calculus and Differential Equation.

Recommended Books: -

1. Mathematics-I by Dr. Deepak Singh (Download from <https://ekumbh.aicte india.org/dbook.php>)
2. Mathematics-II by Dr. Garima Singh (Download from <https://ekumbh.aicte india.org/dbook.php>)
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi.

Reference Books

1. Elements of Mathematics Volume-I and II. (Odisha State Bureau of Text book preparation and production.)
2. Text book of Mathematics, NCERT volume-I and II.

Fundamentals of Computing and Artificial Intelligence
Course Code- TH 5
(1st Year)

Period per week	2	Progressive Assessment:	30 Marks
Total Period	64	End Exam	70 Marks
Duration of End Exam.	3 Hours	No. of credit	2

Course outcomes:

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

CO1: Explain the basic organization of a computer system, including input/output devices, CPU, and memory components.

CO2: Describe different types of software, operating systems, their functions, and classifications.

CO3: Explain fundamental concepts of computer networks, Internet, networking devices, and common Internet services.

CO4: Apply problem-solving techniques by developing algorithms and flowcharts for simple computational problems.

CO5: Develop Python programs using variables, data types, operators, conditional statements, and loops to solve basic problems.

CO6: Describe the fundamentals of Artificial Intelligence, Generative AI, Machine Learning, and Deep Learning along with their applications in daily life.

Course Contents:

Unit 1: Basic Organization of computer

10

- Introduction to Computer
- Functional block diagram of computer
- Input units: Keyboard, Mouse, Scanner, Joystick
- Output units: Monitor, Printer, Speaker
- CPU: ALU, Control unit
- Memory: Primary memory, secondary memory (HDD, SSD)
- Memory Hierarchy

Unit 2: Computer software

10

- Types of software (System software, Application software, utility software)
- What is Operating Systems
- Functions of Operating Systems
- Types of Operating Systems (GUI, CUI, Multi-programmed, Timesharing & Real time)
- Computer Virus (Boot Sector Virus, Macro Virus, Memory Resident Virus, Polymorphic Virus, File Infector Virus)
- Anti-virus softwares
- prevention of Virus

Unit 3: Computer Networks and Internet

12

- Basic concept of computer networking
- Types of Networks (PAN, LAN, MAN, WAN)
- Transmission media (wired and Wireless media)
- Networking Devices (Hub, Switch, Router) (definitions only)
- Basic concept of internet, ISP, Web browser and search engines
- Internet Services (E-Mail, WWW, Chatting, Conferencing, Online Shopping)
- Awareness about Digital India portals (state and national portals).

Unit 4: Problem Solving Methodology

10

- Algorithm
- Flowchart
- Examples of Problem solving through Flowchart
 - a) Write a program to determine sum and average of 5 numbers.
 - b) Write a program to find the greatest number among two numbers.
 - c) Write a program to check the input number is even or odd.
 - d) Write a program to find the average of n numbers by using for loop.
 - e) Write a program to find the factorial of a number.

Unit 5: Python Essentials

15

- Basic Python Syntax
- Input and print statements
- Variables & Constants
- Data Types (int, float, string)
- Operators (Arithmetic, Assignment, Logical, Comparison)
- Conditional Statements (if, if...else, if...elif...else)
- Loops (for, while)

Unit 6: Introduction to AI & Fundamentals of AI

07

- Definition of Artificial Intelligence (AI)
- Goals and Characteristics of AI
- Importance and Applications of AI
- AI in Daily life
- Definition of Generative AI
- Definition of Machine Learning
- Definition of Deep Learning

Examination	Units to be Covered
Internal Assessment-1	Unit-1, Unit -2
Internal Assessment -2	Unit -3, Unit -4
Internal Assessment -3	Unit -5, Unit -6
End Exam	Unit -1, Unit -2, Unit-3, Unit-4, Unit-6

REFERENCES:

1	Computer Fundamentals, by E. Balaguruswamy, TMH
2	R.S. Salaria, Computer Fundamentals, Khanna Publishing House
3	Reema Thareja, Python Programming Using Problem Solving Approach, Oxford University Press, New Delhi, 2017.
4	Computer Fundamentals Author: P. K. Sinha Publisher: BPB Publications
5	Basics of Artificial Intelligence & Machine Learning by Dr. Dheeraj Mehrotra

FUNDAMENTALS OF ELECTRICAL & ELECTRONICS ENGINEERING
Course Code- TH 6

Period per week:	2	Progressive Assessment:	30 Marks
Total Period:	64	End Exam:	70 Marks
Duration of End Exam	3 Hours	No. Of Credit:	2

Course Outcome-

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

- ✓ Acquire knowledge on Electrical and magnetic circuit parameters & AC circuits
- ✓ Basic analysis of Machines & Transformer
- ✓ Analyze measuring instruments, domestic wiring, and apply the knowledge for power billing calculations.
- ✓ Identify & analyze different types of electronics components.
- ✓ Analyze basic electronic and op-amp circuits & digital circuits.

Course Content:

Unit I Electric and Magnetic Circuits:

Unit	Topics	Allotted hours
I	<u>Electric & Magnetic Circuits:</u> 1.1. Definition of EMF, Current, Potential Difference; Ohm's law and its relation with temp., concept of source and load, relation of V, I&R in series and parallel circuit, voltage and current division rule, Power and Energy, KCL, KVL: simple problems 1.2 Basic Definition of M.M.F, magnetic force, flux, permeability, reluctance, permeance, Electromagnetic induction, Faraday's laws of electromagnetic induction, Lenz's law; Self and mutual inductance, leakage factor. 1.3 Hysteresis loop and BH curve, Analogy between electric and magnetic circuits. 1.4 AC fundamentals: Definitions of Cycle, Frequency, Periodic time, Amplitude, Angular velocity, RMS value, Average value, Form Factor Peak Factor, phase angle	9
II	<u>A.C. Circuits:</u> 2.1 Mathematical and phasor representation of alternating emf and current; 2.2 Voltage and Current relationship in Star and Delta connections (Derivation). 2.3 Impedance, A.C in R circuit, L-circuit and C circuit with phasor, power triangle, power factor, concept of real, reactive and apparent power with units.	8

III	<u>Transformer and DC Machines:</u> 3.1 Fleming's rules, Construction and Working principle of DC machines; 3.2 EMF equations of DC machines and applications. 3.3 General construction and principle of different type of transformers; 3.4 Emf equation and transformation ratio of transformers (single phase).	8
IV	<u>Measuring instruments, Wiring & Power billing:</u> <u>4.1 Measuring instruments</u> Introduction to measuring instruments, types of torques (concept only), concept of PMMC and MI type instruments and its uses (1-phase Ammeter, Voltmeter, wattmeter, energy meter) with connection diagram. <u>4.2 Wiring & Power billing:</u> Types of wiring for domestic installation (concept only), calculate energy consumption in a small electric installation (domestic) with simple numerical.	8
V	<u>Overview of Basic Electronics & Components:</u> 5.1 Passive Active Components: Resistances, Capacitors, Inductors, Diodes, Transistors and their Applications. (Concept and simple problems of Resistance, Capacitor & Inductor) 5.2 Energy bands in solids, Types of materials (insulator, semi-conductor, conductor), intrinsic and extrinsic semiconductors. 5.3 Definition, Classification and Working of Diode (PN junction, LED, Zener) 5.4 Transistor: BJT, Concept of FET, MOS and CMOS (Definition, Types, Symbol & Terminals)	7
VI	<u>Overview of Signals & Analog Circuits:</u> 6.1 DC/AC, voltage/current, periodic/non-periodic signals, average, rms, peak values, different types of signal waveforms 6.2 Analog & Digital Signals: Definitions & Difference 6.3 Ideal/non-ideal voltage/current sources, independent/dependent voltage current sources. (Definitions) 6.4 Diode as rectifier – half wave and full wave rectifier (center taped & bridge). 6.5 Introduction to Clippers & Clampers (Definitions only) 6.6 Transistor (BJT only) as an amplifier, Working of RC Coupled amplifier, Oscillator (only definition & types)	8
VII	<u>ICs & OP-Amps:</u> 7.1 Introduction to ICs, advantages & uses 7.2 741 IC pin configuration, Operational Amplifiers – Characteristics of Ideal Op-Amp, Open loop and closed loop configurations 7.3 Application of Op-Amp as amplifier: adder, differentiator and integrator.	8

VIII	Overview of Digital Electronics: 8.1 Number Systems: Binary, Octal, Hexadecimal, Simple problems of Number system, 8.2 Introduction to Logic Gates (Circuit symbol & Truth table), Universal Logic gates, De' Morgans Law 8.3 Implementation of Boolean expression using logic gates (simple problem)	8

N.B.

Portion for 1st Internal Assessment: Unit I & Unit V

Portion for 2nd Internal Assessment: Unit II, Unit VI & Unit VII

Portion for 3rd Internal Assessment: Unit III, Unit IV & Unit VIII

Portion for End Exam: Unit I, Unit IV, Unit VI & Unit VIII

References:

1. Fundamentals of Electrical and Electronics Engineering by Prof. Susan S. Mathew
(Download from <https://ekumbh.aicte-india.org/dbook.php>)
2. Ritu Sahdev, Basic Electrical Engineering, Khanna Publishing House
3. Mittle and Mittal, Basic Electrical Engineering, McGraw Education, New Delhi, 2015, ISBN: 978-0-07-0088572-5
4. Saxena, S. B. Lal, Fundamentals of Electrical Engineering, Cambridge University Press, latest edition ISBN: 9781107464353
5. Theraja, B. L., Electrical Technology Vol – I, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924405
6. Theraja, B. L., Electrical Technology Vol – II, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924375
7. Jegathesan, V., Basic Electrical and Electronics Engineering, Wiley India, New Delhi, 2015, ISBN : 97881236529513
8. Sedha, R.S., A text book of Applied Electronics, S.Chand, New Delhi, 2008, ISBN-13: 978-8121927833
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
11. Singh, Surjit, Electrical Estimating and Costing, Dhanpat Rai and Co. New Delhi, ISBN:1234567150995
12. Gupta, J B: A Course in Electrical Installation Estimating and Costing, S K Kataria and Sons, New Delhi, ISBN:978-93-5014-279-0
13. Tools/ learning physics software/you Tube videos/ websites etc.

ENGINEERING MECHANICS
Course Code- TH 7
(Common to All Branches)

Period per week:	2	Progressive Assessment:	30 Marks
Total Period:	64	Term End Exam:	70 Marks
Duration of End Exam	3 Hours	No. Of Credit:	2

Course Outcomes:

After completing this course, student will be able to:

1. Analyze the coplanar force system and find out the resultant force by applying Principle of Engineering Mechanics.
2. Determine unknown forces of different engineering systems by applying laws of equilibrium.
3. Apply the principle of friction in various conditions when the object is in static equilibrium.
4. Find the centroid, center of gravity and Moment of Inertia of various components in engineering system.
5. Analyze different simple machines to find out different influencing parameters viz. Mechanical Advantage, Velocity Ratio and Efficiency.
6. Identify different types of gear drive and gear train and Determine Velocity Ratio of Gear Train.

Topic wise distribution of periods

Sl. No.	Topics	Periods
01	Introduction to Mechanics	04
02	Force system	10
03	Equilibrium	10
04	Friction	08
05	Centroid and Centre of Gravity	10
06	Moment of Inertia	06
07	Simple lifting machine	12
08	Gear and Gear Train	04

Course Contents:

Unit:1 Introduction to Mechanics

- 1.1. Significance and relevance of Mechanics, Applied mechanics, Statics, Dynamics, Space, time, mass, particle, flexible body and rigid body.
- 1.2. Scalar and vector quantity, Units of measurement (SI units), Fundamental units and derived units.
- 1.3. Force – unit, representation as a vector and by Bow's notation
- 1.4. Characteristics and effects of a force, Principle of transmissibility of force.

Unit:2 Force system

- 2.1 Force system and its classification.
- 2.2 Resolution of a force - Orthogonal components of a force,
- 2.3 Moment of a force, Law of moment, State Varignon's Theorem, Couple and it's moment.
- 2.4 Composition of forces, Resultant force.
- 2.5 Analytical method for determination of resultant for concurrent, non-concurrent and parallel co-planar force system
- 2.6 Triangle Law of forces and Polygon Law of forces (Statement Only), Parallelogram law of Forces (Statement and Derivation)
- 2.7 Simple Numerical on above.

Unit:3 Equilibrium

- 3.1 Equilibrium and Equilibrant, Condition of Equilibrium
- 3.2 Free body and Free body diagram.
- 3.3 Analytical and graphical methods of analyzing equilibrium.
- 3.4 Lami's Theorem – Statement and Explanation.
- 3.5 Application for various engineering problems.
- 3.6 Simple Numerical on above.
- 3.7 Beam: Types of Loads, Beam, Supports with their Reactions with neat sketch.

Unit:4 Friction

- 4.1 Friction and its relevance in engineering, types.
- 4.2 Laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose.
- 4.3 Relation between co-efficient of friction and angle of friction.
- 4.4 Simple Numerical on above
- 4.5 Equilibrium of bodies on level surface subjected to force parallel and inclined to plane.
- 4.6 Equilibrium of bodies on inclined plane subjected to force parallel to the plane only.
- 4.7 Ladder Friction
- 4.8 Simple Numerical on above

Unit:5 Centroid and Centre of Gravity

- 5.1 Definition of Centroid, Centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle)
- 5.2 Centroid of composite figures composed of not more than three geometrical figures.
- 5.3 Locate centroid of C, I, L and T Section.
- 5.4 Definition of Centre of Gravity (C.G.), Centre of Gravity of simple solids (Cube, cuboid, cone, cylinder, sphere, hemisphere) (Expression Only)

Unit:6 Moment of Inertia

- 6.1 Definition of Moment of Inertia (M.I.), M.I. of Plane Figures- rectangle, square, triangle, circle, semicircle. (Only Expression)
- 6.2 Parallel Axis Theorem (Statement and Proof)
- 6.3 Perpendicular Axis Theorem (Statement and Proof)
- 6.4 Determination of Moment of Inertia of Composite Section (I and T-Section).

Unit:7 Simple Lifting Machine

- 7.1 Simple lifting machine, load, effort, mechanical advantage, Velocity ratio (V.R.), efficiency of machines, Applications and advantages
- 7.2 Law of machine, Ideal machine, friction in machine, maximum Mechanical advantage and efficiency.
- 7.3 Reversible and non-reversible machines, conditions for reversibility.
- 7.4 Determination of MA, VR and Efficiency of Simple Axle and wheel, Differential Axle and Wheel
- 7.5 Determination of MA, VR and Efficiency of Worm and worm wheel
- 7.6 Determination of MA, VR and Efficiency of Single purchase and double purchase crab winch
- 7.7 Determination of MA, VR and Efficiency of Simple Screw Jack
- 7.8 Determination of MA, VR and Efficiency of 1st, 2nd and 3rd System of Pulleys.
- 7.9 Simple Numerical on above.

Unit:8 Gear and Gear Train

- 8.1 Gear, Gear Drive, Types of Gear Drive
- 8.2 Gear Train, Types of Gear Train
- 8.3 Velocity Ratio of Simple and Compound Gear Train
- 8.4 Numerical on Simple and Compound Gear Train

N.B.

EXAM	NO OF UNITS COVERED
IST Internal Assessment	Unit-1, Unit-2 & Unit-3
2ND Internal Assessment	Unit-4, Unit-5 & Unit-6
3RD Internal Assessment	Unit-7 & Unit-8
END EXAM	Unit-2, Unit-3, Unit-5, Unit-7 & Unit-8

Suggested Learning Resources:

1. Engineering Mechanics by Prof. Bhankhar Bharat Gokaldas (Download from <https://ekumbh.aicte-india.org/dbook.php>)
2. D.S. Bedi, Engineering Mechanics, Khanna Publications, New Delhi (2008)
3. Khurmi, R.S., Applied Mechanics, S. Chand & Co. New Delhi.
4. Bansal R K, A text book of Engineering Mechanics, Laxmi Publications.
5. Ramamrutham, Engineering Mechanics, S. Chand & Co. New Delhi.
6. Dhade, Jamadar & Walawelkar, Fundamental of Applied Mechanics, Pune Vidhyarthi Gruh.
7. Ram, H. D.; Chauhan, A. K., Foundations and Applications of Applied Mechanics, Cambridge University Press.
8. Meriam, J. L., Kraige, L.G., Engineering Mechanics- Statics, Vol. I, Wiley Publication, New Delhi.

COMMUNICATION SKILLS IN ENGLISH LAB (YEARLY PATTERN)

Course Code- PR 1

(Common to all branches)

Period per week:	02	Progressive Assessment:	25 Marks
Total Period:	64	End Sem:	25
Duration of End Exam.	02 hours	No of Credit:	01

COURSE OUTCOME:

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

1. Apply 4 skills i.e Listening, Speaking, Reading and Writing effectively in day-to-day life.
2. Use of correct pronunciation, intonation, stress, rhythm, speed and pause while communicating with others
3. Comprehend the basic etiquette of interview, GD, Conversation and Presentation
4. Analyze a given topic and implement it in real life situations.
5. Build vocabulary and use in every day situation.

Course Content: (All the activities should be recorded for assessment.)

Unit 1 : Listening Skills

(16 hours)

Listening Process and Practice: stories, poems, interviews and speeches

Activities:

1. Fill in the blanks after listening to an interview.
2. . Fill in the blanks after listening to a poem.
3. After listening to a short story with a morale, summarize it.
4. List important information/ideas after listening to a speech.

Unit II : Reading Skills

(16 hours)

Sounds: Consonant, Vowel, Diphthongs, Reading Activities, homophones and homonyms

Activities:

1. Read aloud a given text and locate homophones and homonyms
2. Read aloud a given passage and list unfamiliar words and record the synonyms and antonyms of those words

Unit III: Speaking Skills

(32 hours)

Standard and formal speech: Group Discussion, Oral Presentations, Public Speaking, Conversation practice (face to face and telephonic) and Role play

Activities:

1. Role plays (Doctor-Patient, Bank Manager- A student to open an account, Receptionist-customer)
2. Self-introduction
3. Anchoring on a given formal situation (welcome and farewell meeting)
4. Record viewpoints of individual participants in a group discussion on any one of the following topics:
 - a. use of mobile phones in institute premises
 - b. government job/Job in MNCs
 - c. hard work vs intelligence
 - d. skill vs knowledge
5. Talk to a friend over telephone inviting him/her to attend your birthday party.
6. face to face conversation with a friend on career selection

This is a course for enhancing LSRW skills. The more you practice, the better you communicate

Recommended Readings:

1. Bansal And Harrison. *Spoken English*. Orient Black Swan, 2011.
2. James Hartman & et al. Ed. *English Pronouncing Dictionary*. Cambridge: Cambridge University Press, 2006.
3. Kulbhushan Kumar, *Effective Communication Skills*, Khanna Publishing House, New Delhi (Revised Ed. 2018)
4. J.D.O'Connor. *Better English Pronunciation*. Cambridge: Cambridge University Press, 1980.
5. Lindley Murray. *An English Grammar: Comprehending Principles and Rules*. London: Wilson and Sons, 1908.
6. Margaret M. Maisson. *Examine your English*. Orient Longman: New Delhi, 1964.
7. J.Sethi & et al. *A Practice Course in English Pronunciation*. New Delhi: Prentice Hall, 2004.
8. Pfeiffer, William Sanborn and T.V.S Padmaja. *Technical mmunication: A Practical Approach*. 6th edn. Delhi: Pearson, 2007.

APPLIED PHYSICS LAB

Course Code - PR2

Period per week:	2	Progressive Assessment:	25 Marks
Total Period:	64	End Sem Exam:	25 Marks
Duration of End Exam	2 Hours	No. of Credit:	1

Practical Course Outcomes (PCOs)

Course Outcomes (COs)

CO1:

Use precision measuring instruments such as Vernier callipers, screw gauges, and spherometers to determine the dimensions and physical parameters of various objects with accuracy.

CO2:

Apply the principles of mechanics to verify laws of forces, friction, Hooke's law, and determine the moment of inertia of a flywheel through experimental investigations.

CO3:

Demonstrate and verify the fundamental laws of geometrical optics, including reflection and refraction, and determine optical parameters using appropriate laboratory techniques.

CO4:

Perform electrical circuit experiments to verify Ohm's law, Kirchhoff's laws, and the laws of resistances in series and parallel combinations.

CO5:

Analyze capacitor and galvanometer characteristics by determining capacitance, permittivity of air, galvanometer resistance, and converting a galvanometer into measuring instruments such as ammeters and voltmeters.

CO6:

Investigate the electrical behaviour of semiconductor devices by plotting V-I characteristics of diodes and determining important parameters such as knee voltage.

List of Practical's/Activities

1. To measure length, radius of a given cylinder, a test tube and a beaker using a Vernier caliper and find volume of each object.
2. To determine diameter of a wire, a solid ball and thickness of card board 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.

Or

To find the co-efficient of friction between wood and glass using a horizontal board.

5. To determine force constant of a spring using Hooke's Law.
6. To find Moment of Inertia of a fly wheel.

Or

To find the viscosity of a given liquid (Glycerin) by Stoke's law.

7. To verify laws of reflection from a plane mirror/interface.
8. To verify laws of refraction (Snell's law) using a glass slab.
9. To verify Ohm's law plotting graph between current and potential difference.
10. To verify laws of resistances in series and parallel combination.
11. To verify Kirchhoff's law using electric circuits.
12. To study the dependence of capacitance of a parallel plate capacitor on various factors and determines permittivity of air at a place.
13. To find resistance of a galvanometer by half deflection method.
14. To convert a galvanometer into an ammeter.
15. To convert a galvanometer into a voltmeter.
16. To draw V-I characteristics of a semiconductor diode (Ge,Si) and determine its knee voltage.

References:

1. Applied Physics-I& II by Prof.Vinod Kumar Yadav (Download from <https://ekumbh.aicte-india.org/dbook.php>)
2. Comprehensive Practical Physics ,Vol,I&II, J N 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/YouTube videos/websites.

APPLIED CHEMISTRY LAB

Course Code – PR 3

Period per Week	2	Progressive Assessment:	25 Marks
Total Periods	64	Final Exam:	25 Marks
Duration of End Exam	2 Hours	No. of Credits:	1

Course Outcome:

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

- 1) Explain various methods of volumetric analysis i.e., Redox, Iodometric, complexometric, Neutralization etc. and use of conductivity meter for measurement of conductance of water sample.
- 2) Apply the use of internal and external indicators and their comparison for redox titrations and mechanisms of iodometric titrations and use of double indicator method in a single titration.
- 3) Estimate the % values of moisture, volatile matter, ash and carbon of fuel by Proximate analysis and instrument handling.
- 4) Analyze the properties of lubricants viz. Flash & fire point, viscosity, cloud & pour point and their significance.
- 5) Estimate the various water quality parameters viz. BOD, COD, DO, Chlorine, TDS, etc. of the sample water.

LIST OF PRACTICALS:

Volumetric and Gravimetric analysis:

1. Preparation of standard solution of oxalic acid or potassium permanganate.
2. To determine strength of given sodium hydroxide solution by titrating against standard oxalic acid solution using phenolphthalein indicator.
3. Standardization of KMnO_4 solution using standard oxalic acid and determine the percentage of iron present in given Hematite ore by KMnO_4 solution.
4. Iodometric estimation of copper in the copper pyrite ore.
5. Volumetric estimation of total acid number (TAN) of given oil.
6. Volumetric estimation of
 - a) Total hardness of given water sample using standard EDTA solution.
 - b) Alkalinity of given water sample using 0.01M sulphuric acid
7. Proximate analysis of coal
 - a) Gravimetric estimation moisture in given coal sample
 - b) Gravimetric estimation ash in given coal sample

Instrumental analysis

8. Determine the conductivity of given water sample.
9. Determination of the Iron content in given cement sample using colorimeter.
10. Determination of calorific value of solid or liquid fuel using bomb calorimeter.
11. Determination of viscosity of lubricating oil using Redwood viscometer.
12. Determination of flash and fire point of lubricating oil using Able's flash point apparatus.
13. To verify the first law of electrolysis of copper sulfate using copper electrode.
14. Construction and measurement of emf of electrochemical cell (Daniel cell).
15. Determination of amount of dissolved oxygen present in a water sample.
16. Determination of amount of BOD present in a water sample.
17. Determination of amount of dissolved chlorine present in a water sample.
18. Determination of amount of COD present in a water sample.
19. Determination of amount of turbidity present in a water sample.
20. Determination of amount of TDS present in a water sample.

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

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

- Encouraging students to visit to sites such as Railway station and research establishment around the institution.

Reference Books:

- ✓ Applied Chemistry by Dr. Anju Rawlley (Download from <https://ekumbh.aicteindia.org/dbook.php>)
- ✓ Text Book of Chemistry for Class XI & XII (Part-I, Part-II); N.C.E.R.T., Delhi, 2017-18.
- ✓ Dr. G. H. Hugar and Prof A. N. Pathak, Applied Chemistry Laboratory Practices, Vol. I and Vol. II, NITTTR, Chandigarh, Publications, 2013-14.
- ✓ Agnihotri, Rajesh, Chemistry for Engineers, Wiley India Pvt. Ltd., 2014.
- ✓ Jain & Jain, Engineering Chemistry, Dhanpat Rai and Sons; New Delhi, 2015.

COMPUTING AND ARTIFICIAL INTELLIGENCE LAB

Course Code- PR-4

(1st Year)

Period per week	2	Progressive Assessment:	25 Marks
Total Period	64	End Exam	25 Marks
Duration of End Exam.	2 Hours	No. Of credit	2

Course outcomes:

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

- 1) Perform computer start-up, shutdown, restart operations, and identify major hardware components including input/output devices, CPU, memory, and motherboard components.
- 2) Install and configure basic operating systems and demonstrate the use of web browsers, search engines, and Internet services.
- 3) Create, edit, format, save, and print professional documents using word processing software.
- 4) Develop spreadsheets and presentations using appropriate office productivity tools, including data formatting, calculations, charts, and multimedia elements.
- 5) Develop and test Python programs using variables, operators, conditional statements, and loops to solve basic computational problems.
- 6) Utilize Generative AI tools such as ChatGPT, Google Gemini, and Microsoft Copilot for information generation.

Course Contents:

SL NO.	TOPICS FOR PRACTICE	Allotted Time (Hours)
1	Computer Start-Up and Shutdown Operations • Procedure for switching on a computer. • Observation of the booting process. • Proper shutdown procedure. • Restarting a computer.	4
2	Identification of Different Components of a Computer • Input devices • Output devices • CPU • Memory devices and peripherals	4
3	Identification of Various Motherboard Components • CPU socket • RAM slots • BIOS chip • Expansion slots • Storage connectors and power connectors • I/O ports and other onboard components	4

4	Installation of Operating Systems • Installation of Windows operating system on laboratory computers. • Installation of Linux operating system on laboratory computers.	2
5	Web Browser and Internet Usage • Browsing different websites and navigating web pages. • Using various search engines for information retrieval.	2
6	Word Processing using MS Word • Creating and editing documents. • Formatting text, paragraphs, and pages. • Inserting tables, images. • Saving, opening, and printing documents. • Using Print Preview and document viewing options.	8
7	Electronic Spreadsheet using MS Excel • Creating and editing spreadsheets. • Entering and formatting data. • Performing basic calculations and using simple formulas. • Saving, opening, and printing worksheets. • Using Print Preview and worksheet viewing options.	8
8	Presentation Package using MS PowerPoint • Creating and editing presentations. • Formatting slides and applying themes. • Inserting text, images, charts, and multimedia elements. • Saving, opening, and printing presentations. • Using Slide Show and presentation viewing options.	8
9	Programming using Python • Write a program to determine sum and average of 5 numbers. • Write a program to Perform all arithmetic operation (addition, subtraction, multiplication, division) • Write a program to find the greatest number among two numbers. • Write a program to check the input number is even or odd. • Write a program to check the input year is a leap year or not. • Write a program to find the greatest number among three numbers. • Write a program to find the average of n numbers by using for loop. • Write a program to determine whether a number is prime or not. • Write a program to find the factorial of a number. • Write a program to display even numbers from 1 to 50.	20

10	Getting Started with Generative AI Tools • Use ChatGPT • Use Google Gemini • Use Microsoft Copilot	4
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REFERENCES:

1	Computer Fundamentals, by E. Balaguruswamy, TMH
2	Yashavant Kanetkar, Let Us Python, 2nd Edition, BPB Publications, India, 2020.
3	Reema Thareja, Python Programming: Using Problem Solving Approach, 1st Edition, Oxford University Press, India, 2017.
4	Microsoft Office 2019 Step by Step Publisher: <u>Microsoft Press</u>

ENGINEERING WORKSHOP PRACTICE
Course Code- PR 5
(Common to All Branches)

Period per week:	2	Progressive Assessment:	50 Marks
Total Period:	64	End Exam:	50 Marks
Duration of End Exam	2 Hours	No. Of Credit:	1

Course Outcomes:

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

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

Course Content:

Fitting

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

Welding:

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

Sheet Metal Working:

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

Carpentry:

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

References:

1. Engineering Workshop Practice (English) by Dr. A. K. Sarathe (Download from <https://ekumbh.aicte-india.org/dbook.php>)
2. S.K. Hajara Chaudhary, Workshop Technology, Media Promoters and Publishers, New Delhi, 2015
3. B.S. Raghuwanshi, Workshop Technology, Dhanpat Rai and sons, New Delhi 2014
4. K. Venkat Reddy, Workshop Practice Manual, BS Publications, Hyderabad 2014

Kents Mechanical Engineering Hand book, John Wiley and Sons, New York

ENGINEERING GRAPHICS
Course Code- PR 6
(Common to All branches)

Period per week:	2	Progressive Assessment:	50 Marks
Total Period:	64	End Exam	50 Marks
Duration of End Exam	2 Hours	No. Of Credit	1

Course Outcomes:

After completing this course, student will be able to:

1. Understand the importance of Engineering Drawing.
2. Demonstrate the use of different drawing instrument.
3. Make free hand lettering and numbering and Practice of dimensioning of drawing.
4. Practice of projections of straight line, planes and solids.
5. Take up different orthographic and isometric projections.
6. Prepare 2D engineering drawing using Auto CAD software.

1. Introduction & Demonstration:

- Identify various sizes of drawing boards, drawing sheets as per BIS.
- List the types of pencils, instruments, and scales (RF).
- Demonstrate lying of drawing sheet, margin, standard layout and title block as per BIS, folding principle of drawings (blue prints, print outs etc).

2. Types Of Lines, Lettering & Dimensioning

- Demonstrate and explain the use of various types of lines.
- Demonstrate the principle of single stroke, gothic lettering & numerals as per BIS.
- Introduction to Dimensioning, Unit of Dimensioning, General Rules for Dimensioning

3. Scales

- Significance of scales in drawing; different scales.
- Define and draw plain scale and diagonal scale.

4. Orthographic Projections

- 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.

5. Isometric Projections

- Draw isometric view & Isometric projection of prism, pyramid, cone & cylinder with axis horizontal and vertical with construction of isometric scales.

6. Practices On AutoCAD

- Introduction- 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, status bar, 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.

AutoCAD Commands:

- Draw various entities by using commands (Line, circle, arc, polygon, ellipse, rectangle).
- Edit command, Dimension commands and Modify Commands for two dimensional

drafting only.

N.B.: - Print out should be a part of progressive assessment in AutoCAD Practice

References:

1. A Text Book of Engineering Drawing by Dr. R.K. Dhawan.
2. A Text Book of Engineering Graphics & Auto CAD by K Venugopal.
3. A Text book of Engineering Drawing by N.D. Bhatt.
4. Engineering Drawing by P.S. Gill.
5. Introduction to Auto CAD – 2012 by George Omura, Willey India Publisher

FUNDAMENTAL OF ELECTRICAL & ELECTRONICS ENGINEERING LAB

Course Code-PR7

Period per week:	2	Progressive Assessment:	25 Marks
Total Period:	64	End Exam:	-
Duration of End Exam	---	No. of Credit:	1

Course Outcomes:

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

1. Perform measurements of electrical quantities in basic electrical circuits and magnetic circuits using appropriate instruments. Calculate voltage, current and power in 1-phase circuit.
2. Identify the constructional features and operating principles of transformers, DC machines, and electrical measuring instruments. Distinguish various electronic components and measure values using multimeter,
3. Demonstrate electrical wiring practices and analyze domestic electrical energy consumption and billing.
4. Identify and test passive electronic components and determine their characteristics using measuring instruments.
5. Test and analyze the performance of semiconductor devices such as diodes, LEDs, Zener diodes, and transistors.
6. Identify and verify the operation of basic digital logic gates and apply them in simple digital circuits.

Suggested Practical/Exercises:

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

Sl. No.	List of the Practical	No of Hours
1.	Determine the permeability of magnetic material by plotting its B-H curve.	2
2.	Measure voltage, current and power in 1-phase circuit with resistive load	2
3.	Study of 1-phase transformer (structure).	2
4.	Connect single phase transformer and measure input and output quantities. Also determine the transformation ratio(K).	4
5.	Study of different parts of DC machines.	2
6.	Study of PMMC, MI types of instruments (ammeter, voltmeter).	4
7.	Study of PMMC, MI types of instruments (wattmeter, energy meter).	2
8.	Wiring Connection of Fluorescent lamp/tube light.	4
9.	Prepare an electrical switch board to control one light point, one plug point, one fan point and a fuse.	4
10.	Prepare a report on power billing(monthly) of a domestic single phase wiring system.	4
11.	Identify various passive and active electronics components	2
12.	Connect resistors in series and parallel combination and measure its value using digital multimeter	4
13.	Connect capacitors in series and parallel combination and measure its value using multimeter	2
14.	Use multimeter to measure the value of given resistor and determine the value to confirm with colour code	4
15.	Test the PN-junction diode and LED using digital multimeter.	2

16.	Test the performance of PN-junction diode	4
17.	Test the performance of Zener diode	4
18.	Study of half wave and full wave rectifier	6
19.	Identify three terminals of a transistor using digital multimeter	2
20.	Familiarization with different types of logic gates.	4

References:

1. Basic Electrical & Electronics Engg Lab Manual by Partha Sarathi Subhudhi
2. Fundamentals of Basic Electrical & Electronics Engg by T. Chacko, Susan S. Mathew:
Khanna Publishing House, First Edition

ENGINEERING MECHANICS LAB
Course Code- PR 8
(Common to All Branches)

Period per week:	2	Progressive Assessment:	25 Marks
Total Period:	64	End Exam:	---
Duration of End Exam	---	No. Of Credit:	1

Course Outcomes:

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

1. Analyze different simple machines to find out different influencing parameters viz. Mechanical Advantage, Velocity Ratio and Efficiency.
2. Understand the phenomena of friction in different condition and make analysis through experiment to find out coefficient of friction.
3. Determine resultant of various force systems and analyze the equilibrium of a rigid body by Lami's theorem.
4. Determine Centroid of geometrical plane figures.

List of Practical to be performed:

1. To study various equipment's 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 using Simple Screw Jack.
4. Determine M.A., V.R., Efficiency and law of machine using Worm and worm wheel.
5. Determine M.A., V.R., Efficiency and law of machine using Single purchase crab.
6. Determine M.A., V.R., Efficiency and law of machine using double purchase crab.
7. Determine resultant of concurrent force system applying Law of Polygon of forces using force table.
8. Determine resultant of concurrent force system graphically.
9. Determine resultant of parallel force system graphically.
10. Verify Lami's theorem.
11. Study forces in various members of Jib crane.
12. Determine coefficient of friction for motion on horizontal and inclined plane.
13. Determine centroid of geometrical plane figures.

Suggested Learning Resources:

1. Engineering Mechanics by Prof. Bhankhar Bharat Gokaldas (Download from <https://ekumbh.aicte-india.org/dbook.php>)
2. Bedi D.S., Engineering Mechanics, Khanna Publishing House
3. Khurmi, R.S., Applied Mechanics, S. Chand & Co. New Delhi.
4. Bansal R K, A text book of Engineering Mechanics, Laxmi Publications.
5. Ramamrutham, Engineering Mechanics, S., S Chand & Co. New Delhi.
6. Dhade, Jamadar & Walawelkar, Fundamental of Applied Mechanics, Pune Vidyarthi Gruh.
7. Ram, H. D.; Chauhan, A. K. Foundations and Applications of Applied Mechanics, Cambridge University Press.
8. Meriam, J. L., Kraige, L.G., Engineering Mechanics- Statics, Vol. I, Wiley Publication, New Delhi.

SPORTS AND YOGA
Course Code- PR 9

Period per week:	2	Progressive Assessment:	50 Marks
Total Period:	32	End Sem Exam:	-----
		No. Of Credit:	1

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 breathing exercises and healthy fitness activities
- (iii) Understand basic skills associated with yoga and physical activities including strength and flexibility, balance and coordination.
- (iv) Perform yoga movements in various combination and forms.
- (v) Identify opportunities for participation in yoga and sports activities.
- (vi) Improve personal fitness through participation in sports and yogic activities.
- (vii) Assess yoga activities in terms of fitness value.

Course Content:

- **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
- **Postures**
 - Meaning and Concept of Postures.
 - Causes of Bad Posture.
 - Concept & advantages of Correct Posture.
- **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, Pawanuktasana, Ardha Chakrasana, Bhujangasana, Shavasana.
- Obesity: Procedure, Benefits & contraindications for Vajrasana, Hastasana, Trikonasana, Ardha Matsyendrasana.
- Back Pain: Tadasana, Ardha Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana.
- Diabetes: Procedure, Benefits & contraindications for Bhujangasana, Paschimottasana, Pawanuktasana, Ardha 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.

- **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)
