

Diploma in Electrical Engineering

Semester 1

Sr. No	Course Code	Title	L	T	P	Cr
1	AS7101	Mathematics-I	3	2	0	4.0
2	AS7102	Engineering Physics I	3	0	2	4.0
3	AS7103	Engineering Drawing	2	0	4	4.0
4	AS7104	Engineering Mechanics	2	1	0	2.5
5	AS7105	Computing Skill Workshop	0	0	4	2.0
6	AS7106	Communication Skills-I	2	0	2	3.0
7	AS7107	Engineering Workshop Practice	0	0	4	2.0
8.		ELC Activity-I	0	0	0	0
		Total	12	3	16	21.5

Semester 2

Sr. No	Course Code	Title	L	T	P	Cr
1	AS7201	Mathematics-II	3	2	0	4.0
2	AS7202	Chemistry	3	0	2	4.0
3	AS7203	Electrical and Electronics Engineering	3	1	2	4.5
4	AS7204	Engineering Physics II	3	1	2	4.5
5	AS7205	Communication Skills-II	2	0	2	3.0
6	AS7206	Programming in C	3	0	2	4.0
7	AS7207	Environmental Studies	1	0	0	1.0
8		ELC Activity-II	0	0	0	0.0
		Total	18	4	10	25.0

Semester I

AS7101-Mathematics – I

L	T	P	Cr
3	2	0	4.0

Course Objectives: To enable students with essential knowledge and problem-solving skills in algebra, trigonometry, and coordinate geometry, enabling them to formulate and solve mathematical problems arising in engineering applications.

Detailed Contents

Sets & Functions: Sets and their representations, types of sets, Venn diagrams, operations on sets, Relations & Functions, various types of functions.

Trigonometry: Review of trigonometric functions, Sum and product formulae for trigonometric functions, Trigonometric equations and transformation formulae for trigonometric functions, Identities related to double angle formulae.

Algebra: Complex numbers and its properties, Solution of quadratic equations & its applications, Permutations and combinations, Binomial theorem for positive/negative index and its simple applications, Arithmetic and geometric progression.

Determinants and Matrices: Matrices, Operations on matrices, Determinants and its properties, Singular and non-singular matrices, Adjoint and inverse of a matrix and its properties, Solution of system of linear equations using Cramer's rule and matrix method.

Co-ordinate Geometry: Review of cartesian system of coordinates, Straight lines (Slope form, slope intercept form, intercept form, one-point form, two-point form, general form), Circle, conic sections.

Course Learning Outcomes (CLO):

After the completion of this module, students will be able to:

1. understand various types of sets and functions.
2. use trigonometric identities, sum-product and product-sum formulae, and double-angle identities to simplify trigonometric expressions.
3. understand complex numbers, quadratic equations, and Binomial theorem and Arithmetic and Geometric series.
4. study matrix and determinants and their operations, evaluate, and determine the inverse of matrices to solve systems of linear equations using Cramer's rule and matrix method.
5. Plot and interpret standard curves such as straight lines, parabolas, circles,

Text Books:

1. A Text book of Mathematics, Class XI and Class XII (Part I & II), NCERT, New Delhi, (2011)
2. Mathematics class XI by R.D. Sharma, Dhanpat Rai Publications (2012)
3. Mathematics class XII (Vol I and II) by R.D. Sharma, Dhanpat Rai Publications (2012)
4. Thomas' Calculus, George B. Thomas, Pearson Education, 14th edition (2014)

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weights (%)
1.	MST	30
2.	EST	45
3.	Sessional (May include Assignments/Quizzes/Tutorials/Lab Evaluations)	25

AS7102- Engineering Physics – I

L	T	P	Cr
3	0	2	4.0

Course Objectives: This subject provides students with a foundational acquaintance with the fundamental laws of classical physics. It establishes the core concepts of measurement, mechanics, properties of matter, and thermodynamics, which are essential for understanding the physical world and subsequent engineering applications.

Detailed Contents

Units and Dimensions: Units - fundamental and derived units, FPS, CGS and SI system of units, Dimensional formulae of various physical quantities, Principle of homogeneity of dimensions, Dimensional analysis conversion of units from one system to another.

Force and Motion: Scalar and vector quantities, Addition and Subtraction of Vectors, Triangle and Parallelogram law, Resolution of Vectors, Force, Momentum, Conservation of linear momentum, its applications, Impulse and its Applications, Circular motion, definition of related quantities, Relation between linear and angular velocity, linear acceleration and angular acceleration, Angular momentum and torque, Concept of centripetal and centrifugal forces and their applications with examples.

Work, Power and Energy: Work: examples of zero work, positive work and negative work, Friction: concept, types, laws of limiting friction, Energy: Kinetic energy and potential energy with examples and their derivation, Principle of conservation of mechanical energy for freely falling bodies, examples of transformation of energy, Power and its units, calculation of power in numerical problems.

Properties of Matter: Elasticity: definition of stress and strain, Modulus of elasticity, Hooke's law, significance of stress strain curve, Pressure: atmospheric pressure, gauge pressure, absolute pressure, Surface tension: concept, angle of contact, applications of surface tension effect of temperature on surface tension, Viscosity and coefficient of viscosity: Terminal velocity, Stoke's law.

Thermometry: Difference between heat and temperature, Modes of transfer of heat (Conduction, convection and radiation with examples), Different scales of temperature and their relationship, Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions and relation amongst them, Concept of Co-efficient of thermal conductivity.

List of Experiments

1. To find the diameter and depth of a cylinder/wire using a vernier calliper / screw gauge
2. To find the diameter of wire using a screw gauge
3. To determine the thickness of glass strip using a spherometer
4. To verify parallelogram law of forces
5. To study conservation of energy of a cylinder rolling down an inclined plane.
6. To determine the atmospheric pressure at a place using Fortin's Barometer
7. To determine the force constant of spring using Hooke's law.

Course Learning Outcomes (CLO):

After completing the course, the student should be able to:

1. Apply the principle of homogeneity and dimensional analysis to convert physical quantities between FPS, CGS, and SI systems.
2. Resolve vector quantities and apply the laws of conservation of linear momentum to solve problems involving impulse and circular motion.
3. Calculate work, power, and mechanical energy for various systems, including freely falling bodies and inclined planes.
4. Apply Hooke's Law, Stoke's Law, and surface tension concepts to determine the elasticity and viscosity of industrial materials.
5. Apply the principles of heat energy, temperature scales, and heat transfer mechanisms, along with the laws of thermal expansion and conductivity, to analyze and solve practical thermal problems.

Text Books:

1. Serway, R.A., and Jewett, J.W., Physics for Scientists and Engineers, Cengage Learning (2018) 10th ed.
2. Bhattacharya, D.K. and Tandon, P., *Engineering Physics*, Oxford University Press (2015) 1st ed.
3. Avadhanulu, M.N. and Kshirsagar, P.G., A Textbook of Engineering Physics, S. Chand Publishing (2018) 11th ed.

Reference Books:

1. Gaur, R.K. and Gupta, S.L., Engineering Physics, DhanpatRai Publications (2011) 8th ed.
2. H.C. Verma, Concepts of Physics (*Vol. 1 & 2*), BharatiBhawan (2018) 2nd ed.
3. Verma, N.K., Physics for Engineers, Prentice Hall of India (2014) 1sted.

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weights (%)
1.	MST	30
2.	EST	45
3.	Sessional (May include Assignments//Quizzes/Tutorials/Lab Evaluations)	25

AS7103- Engineering Drawing

L	T	P	Cr
2	0	4	4.0

Course Objectives: This module is dedicated to graphics and includes two sections: 2D drafting and 3D modelling of solid objects. The course aims to help students understand the concepts of projection systems and learn how to create projections of solid objects using first- and third-angle orthographic projection, as well as isometric projections. It also covers the concept of sectioning, the interpretation of tolerance dimensions, and the creation and editing of drawings using drafting software. In addition, the course provides insight into basic 3D modelling concepts such as extrusion, revolution, sweeping, and the construction of complex solids.

Detailed Contents

Introduction to Engineering Drawing: Significance of Engineering drawing in industry, Types of Engineering drawings, Different types of lines and sizes of drawing sheets in Engineering drawing as per BIS specifications, Necessity of dimensioning, method and principles of dimensioning, Scales –their needs and importance, Projection systems: First angle and third angle projection system.

Orthographic Projection: Points, Lines, Solid objects: Theory of orthographic projections (Elaborate theoretical instructions), Projection of Points in different quadrant, Projection of Straight Lines (1st and 3rd angle), Lines parallel to both the planes, Lines perpendicular to any one of the reference plane, Lines inclined to any one of the reference plane, Projections of solid objects – multi-view drawings significance and drawing of six principal orthographic views.

Isometric Projections: Fundamentals of isometric projections and isometric scale, Difference between isometric drawings and projections, Drawing the isometric views of solid objects, Isometric views of combination of regular solids like cylinder, cone, cube and prism.

Sections of solids: Importance and salient features of sectioning, Types of Sections, Convention sectional representation of various materials, conventional, breaks for shafts, pipes, rectangular, square, angle, channel, rolled sections, Orthographic sectional views of different objects.

Limits, fits and tolerances: Importance of tolerances and fits, Terminology and basic concepts related to limits and fits, Fundamental deviations of holes and shafts, Types of fits.

2D Drafting: Management of screen menus commands, Creating basic drawing entities, Co-ordinate systems: Cartesian, polar and relative coordinates, Drawing limits, units of measurement and scale, Layering: organizing and maintaining the integrity of drawings, Design of prototype drawings as templates, Editing/modifying drawing entities: selection of objects, object snap modes, editing commands, Dimensioning: use of annotations, dimension types, properties and placement, adding text to drawing.

3D Modelling: Management of screen menus commands, Introduction to basic 3D modelling commands such as extrude, revolve, sweep etc., Creation of 2D drawings from a 3D model.

List of Experiments

1. Drawing sheet layouts and title block.
2. Practice of lines and lettering.
3. Dimensioning practice.
4. Construction and use of plain and diagonal scales.
5. Projection of points.
6. Projection of lines.
7. Orthographic projections of simple solids.
8. Isometric drawing and projection of solids.
9. Sectional views of solids.
10. Limits, fits, and tolerances.
11. Introduction to basic 3D modelling.

Course Learning Outcomes (CLO):

After the completion of this module, students will be able to:

1. Creatively comprehend the geometrical details of common engineering objects.
2. Draw dimensioned orthographic and isometric projections of simple engineering objects.
3. Interpret the meaning and intent of limits, fits and tolerances in the drawing.
4. Create/edit the engineering drawings for simple engineering objects using 2D drafting software.
5. Create/edit 3D models of engineering components using 3D modelling software.

Text Books:

1. Jolhe, D.A., Engineering Drawing, Tata McGraw Hill, (2008).
2. Gill, P.S., Geometrical Drawings, S.K. Kataria & Sons, Delhi (2008).

Reference Books:

1. Gill, P.S., Machine Drawings, S.K. Kataria & Sons, Delhi (2013).
2. Mohan, K.R., Engineering Graphics, Dhanpat Rai Publishing Company (P) Ltd, Delhi (2002).
3. Mastering AutoCAD 2021 and AutoCAD LT 2021, Brian C. Benton, George Omura, Sybex - John Wiley and Sons, Indiana (2021).

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weights (%)
1.	MST	30
2.	EST	45
3.	Sessional (May include Assignments/Quizzes/Tutorials/Lab Evaluations)	25

AS7104- Engineering Mechanics

L	T	P	Cr
2	1	0	2.5

Course Objectives: The subject Engineering Mechanics deals with the fundamental principles of mechanics, including the laws of forces and motion, moments, friction, centre of gravity, and simple machines. These concepts form the foundation required for students to understand various allied and advanced engineering subjects. The study of this subject also enhances students' analytical and problem-solving abilities.

Detailed Contents

Introduction: Concept of engineering mechanics definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields. Concept of rigid body, scalar and vector quantities.

Laws of Forces: Definition and measurement of force in SI units; representation, types, effects and characteristics of force, Newton's laws of motion and gravitation; difference between mass and weight, Force systems (coplanar and non-coplanar), principle of transmissibility of forces, and law of superposition, Composition and resolution of coplanar concurrent forces; resultant force; triangle and polygon laws of forces; resolution of a force into rectangular components. Free body diagram, equilibrant force and its determination, and Lami's theorem (concept only).

Moments: Concept of moment; moment of a force and its units; Varignon's theorem; principle of moments and its applications, Parallel forces (like and unlike) and determination of their resultant; concept of couple, its properties and effects; general conditions of equilibrium of bodies under coplanar forces; and determination of the position of the resultant force using the principle of moments.

Friction: Concept of friction; types of friction and force of friction; laws of static friction; coefficient of friction; angle of friction, angle of repose, and cone of friction. Equilibrium of a body on a horizontal plane and on a rough inclined plane: when the applied force acts along the plane, horizontally, or at an angle to the inclined plane.

Centroid and Centre of Gravity: Concept and definition of centroid of plane figures and centre of gravity of symmetrical solid bodies, Determination of centroid of simple and composite lamina using the moment method. Determination of the centre of gravity of solid bodies such as cone, cylinder, hemisphere, and sphere, including composite bodies and bodies with portions removed.

Simple Machines: Definition of effort, velocity ratio, mechanical advantage, and efficiency of a machine and their relationship; law of machines. Simple and compound machines; ideal, reversible, and self-locking machines; effort and load lost in friction; determination of maximum mechanical advantage and maximum efficiency, Systems of pulleys with determination of velocity ratio, mechanical advantage, and efficiency.

Course Learning Outcomes (CLO):

After the completion of this module, students will be able to:

1. Determine the resultant of coplanar concurrent forces and draw free body diagrams.
2. Calculate the least force required to maintain equilibrium on an inclined plane.
3. Determine the centroid/centre of gravity of plain and composite laminar and solid bodies.
4. Determine velocity ratio, mechanical advantage and efficiency of simple machines.

Text Books:

1. Ramamurtham, S, "A Text Book of Applied Mechanics", Dhanpat Rai Publishing Co. Ltd.
2. Khurmi, RK, "A Text Book of Engineering Mechanics (Applied Mechanics)", S Chand and Co. Ltd., New Delhi.

Reference Books:

1. Rajput, RK, "A Text Book of Applied Mechanics", Laxmi Publications, New Delhi.
2. Singh, Birinder, "Text Book of Applied Mechanics", Kaption Publishing House, New Delhi.
3. Upadhyaya, AK, "Text Book of Applied Mechanics", SK Kataria & Sons, New Delhi.

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weights (%)
1.	MST	30
2.	EST	45
3.	Sessional (May include Assignments/Quizzes/Tutorials/Lab Evaluations)	25

AS7105- Computing Skill Workshop

L	T	P	Cr
0	0	4	2.0

Course Objectives: The objectives of this course are to familiarize students with the basic components of computer hardware and commonly used peripherals, develop essential skills in operating systems and file management, and enable them to use standard office productivity software effectively. The course also aims to introduce students to safe and efficient use of the internet and digital services, while building basic awareness of computer maintenance, troubleshooting techniques, and fundamental cybersecurity practices.

Detailed Contents

Introduction to Computer Hardware: Identification of computer components: CPU, monitor, keyboard, mouse. Understanding input, output, and storage devices. Starting and shutting down a computer safely. Internal Hardware Familiarization: Identification of motherboard, RAM, ROM, HDD/SSD, SMPS, processor. Demonstration of assembling and disassembling a desktop computer. Understanding ports, connectors, and expansion slots. Peripheral Devices: Installation and use of printer, scanner, webcam, speakers. Identifying different types of cables and connectors. Power Supply and Safety: Introduction to UPS and its operation.

Operating System and File Management: Overview of Windows and Linux operating systems, BIOS, Booting process and user login, Understanding desktop, taskbar, icons, and control panel. File and Folder Management: Creating, renaming, copying, moving, and deleting files/folders. Using storage devices and disk management basics. Installing and uninstalling simple application software.

Office Productivity Tool: Word Processing (MS Word): Creating, saving, and formatting documents. Using fonts, paragraphs, tables, and page setup. Creating simple reports, letters, and resumes. Spreadsheet Application (MS Excel): Creating worksheets, Using basic formulas and functions, Formatting cells, rows, and columns, sorting data, filtering data, formulas and operators, cell referencing, basic functions, logical functions, text functions, conditional formatting, data validation, charts (bar, pie, line, column), pivot tables, pivot charts, Presentation Software (MS PowerPoint): Creating slide presentations, Inserting text, images, and shapes, Applying themes, animations, and slide transitions.

Internet, Email and Digital Tools: Internet Basics: Understanding web browsers, search engines & AI tools, Downloading and uploading files. Email and Online Communication: Creating and using email accounts. Introduction to Online Services: Using cloud storage, Online forms and basic digital services.

List of Experiments

Hands-on sessions for each unit and Practice-based evaluation through tasks and demonstrations

1. Identification of Computer Hardware
2. Internal Hardware Demonstration
3. Peripheral Devices Setup
4. Operating System and File Management

5. Word Processing using MS Word
6. Spreadsheet using MS Excel
7. Practical applications such as marksheet, attendance sheet, and salary sheet.
8. Presentation using MS PowerPoint
9. Internet, Email & Security Basics

Course Learning Outcomes (CLO):

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

1. Identify and use basic computer hardware components.
2. Operate computers using modern operating systems.
3. Install and uninstall various system and application software.
4. Manage files, folders, and storage devices efficiently.
5. Create professional documents, spreadsheets, and presentations.
6. Use the internet, email, and online tools safely and effectively
7. Perform basic system maintenance and troubleshooting tasks

Text Books:

1. Introduction to Computers – Peter Norton, Tata McGraw Hill
2. PC Hardware & Components and PC Architecture – Prof. Satish Jain, BPB Publications
3. Microsoft Office: Step by Step- JeonLambort Pearson Publication

Reference Books:

1. PC Upgrade and Maintenance Guide by Mark Minasi, BPB Publication
2. Hardware Bible by Winn Rosch, Techmedia Publications

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weights (%)
1.	Evaluation (May include Assignments/Quizzes/Tutorials/Lab Evaluations)	100

AS7106-Communication Skills-I

L	T	P	Cr
2	0	2	3.0

Course Objectives: This course aims to build functional English language competence and communication skills by integrating grammar, vocabulary, reading, writing, speaking, and listening with practical communicative activities for academic and professional contexts.

Detailed Contents

Functional Grammar and Vocabulary: Parts of speech, Articles, Tenses, Subject-verb agreement, Active and passive voice, Synonyms and antonyms, Pairs of words, Correction of incorrect sentences.

Basics of Communication: Definition and process of communication, Objectives & Essentials of communication, Introduction to types of communication, Barriers to communication.

Effective Speaking & Listening: Importance of speaking effectively, Methods to improve speaking. Listening vs hearing, Importance of listening, Active listening – Meaning and strategies, Methods to improve listening skills.

Reading: Techniques of reading: skimming, scanning, intensive and extensive reading, Comprehension, vocabulary enrichment and grammar exercises based on the following readings:

- The Gift of the Magi – O. Henry
- Where the Mind is Without Fear – Rabindranath Tagore

Writing: Significance and effectiveness of writing, Word choice, Sentence formation and Construction of Paragraph

List of Experiments

1. Self and peer introduction
2. Just a Minute session – extempore
3. Situational conversation and role play
4. Group Discussions
5. Improving pronunciation through tongue twisters.
6. Vocabulary building exercises
7. Language learning using open-source software/Duolingo

Course Learning Outcomes (CLO):

Upon completion of this course, students will be able to:

1. Apply and analyse grammar and vocabulary rules to construct accurate and meaningful sentences.
2. Examine the communication process to identify barriers and select suitable communication strategies.
3. Demonstrate and evaluate effective speaking and listening skills in academic and professional situations.
4. Analyse and interpret texts using appropriate reading techniques to improve comprehension

and vocabulary.

5. Create clear and well-organized paragraphs using appropriate word choice and sentence structure.

Text Books:

1. Revathi, Srinivas, "Communicating Effectively in English, Book-1", Abhishek Publications, Chandigarh.
2. Mohan, Krishna & Meera Banerji, "Developing Communication Skills (2nd Edition)", Published by Macmillan Publishers India Ltd; New Delhi.
3. Eastwood, John, "Oxford Practice Grammar", Oxford University Press, London
4. Chadha, R. K., "Communication Techniques and Skills", Dhanpat Rai Publications, New Delhi.
5. Wren & Martin, "High School English Grammar and Composition", S. Chand & Company Ltd., Delhi.
6. Kumar, Sanjay & Pushp Lata, "Communication Skills", Oxford University Press, New Delhi

Websites for Reference:

- [http://www.mindtools.com/ page 8.html](http://www.mindtools.com/page 8.html)
- <http://www.letstalk.com.in>
- <http://www.englishlearning.com>
- <http://learnenglish.britishcouncil.org/en/>

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weights (%)
1.	MST	30
2.	EST	45
3.	Sessional (May include Assignments//Quizzes/Tutorials/Lab Evaluations)	25

AS7107- Engineering Workshop Practice

L	T	P	Cr
0	0	4	2.0

Course Objectives: Develop practical skills in basic workshop operations such as fitting, carpentry, welding, sheet metal work, machining, and electrical assembly. Familiarize students with tools, machines, and safety practices in conventional manufacturing. Enable fabrication of simple components by interpreting drawings and maintaining dimensional accuracy. Introduce basic machining operations (turning, facing, milling, and CNC concepts) and develop hands-on problem-solving skills through measurement, marking, joining, and assembly.

Detailed Contents

Welding: Demonstration of different welding tools/machines, Demonstration on Arc Welding, Gas Welding, MIG welding, gas cutting. Introduction to welding simulator basic settings and user interface, application and benefit of simulator, standard operating procedure for simulator and safety guidelines, case studies on application of simulator.

Carpentry: Demonstration of different wood working tools / machines, Demonstration of different wood working processes, like planing, marking, chiselling, grooving, turning of wood etc.

Sheet Metal: 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.

Fitting: Demonstration of different fitting tools and drilling machines and power tools, Demonstration of different operations like filing, drilling, tapping, sawing, cutting etc.

Conventional Lathe: Types of lathes, Specifications, Basic parts and their functions, Operations and tools – step turning, taper turning, parting off, knurling, facing.

Conventional Milling: Types of milling machines, constructional details – specifications, milling operations, milling cutters – types, Tool & work holding devices.

Simulation: Explain an overview on CNC Simulation Software on turning and milling centre, Explanation of G and M codes. Explain Absolute and Incremental system, Explain Linear interpolation and Circular interpolation. Explain cutting Parameters – Feed, Speed and depth of cut with respect to CNC machine.

CNC Lathe: CNC vs. Conventional Lathe: Advantages, limitations, and applications, Components of a CNC Lathe, Safety precautions, maintenance, and emergency stops, Modes of operation, Tools and Workpiece holding devices, setting tools and work offsets, Programming simple turning, facing, and step turning.

CNC Milling: CNC vs. Conventional milling: Advantages, limitations, and applications, Components of a CNC milling, Safety precautions, maintenance, and emergency stops, Modes of operation, different cutting tools and workpiece holding devices, Setting tools and work offsets, Programming simple end and face milling.

Electrical: Introduction, functions and specifications of different types of tools, wires, cables, switches, fuses, cleats, clamps, allied items, and accessories used in Electric shop. Introduction to lead acid battery and nickel cadmium battery. Demonstration and identification of common electrical materials with standard ratings and specifications such as wires, cables, switches, fuses, cleats, clamps and allied items, tools and accessories, Demonstration of common electrical appliances and batteries.

List of Experiments

Sr. No.	Name of Practical	Workshop
1	Lap joint / T-joint by Arc Welding	Welding
2	Cross lap joint	Carpentry
3	Single/Double Seam Lap Joint	Sheet Metal
4	Rectangular block with chamfer.	Fitting
5	Cylindrical Job with steps (including Facing and Turning operations)	Conventional Lathe
6	Develop a rectangular job with tolerances using End Milling	Conventional Milling
7	Simple CNC program for understanding Tool path on CNC Machines (Lathe and Milling)	Simulation
8	To develop a job (Facing and Turning) on cylindrical workpiece	CNC Lathe
9	To develop a job (End Milling) on Flat Surface workpiece	CNC Milling
10	To develop a series and parallel circuit.	Electrical
11	To develop different welding joints in GMAW for different welding positions	Welding Simulator
12	To develop different welding joints in GTAW and gas welding for different welding positions	Welding Simulator

Course Learning Outcomes (CLO):

After the completion of this module, students will be able to:

1. Demonstrate basic fabrication and joining techniques using welding, sheet metal, and carpentry processes.
2. Apply bench work and forming operations to produce components with required shape and finish.
3. Operate conventional machine tools to manufacture components within specified tolerances.
4. Interpret and execute CNC machining operations using simulation and machine tools.
5. Assemble and test basic electrical circuits following safety practices.

Text Books:

1. Hajra, SK, Choudhary, AK, Workshop Technology - Volume I, II, III, Media Promoters and Publishers Pvt. Ltd. Mumbai.
2. Raghuvanshi, B.S., Workshop Technology, Dhanpat Rai and Co., New Delhi
3. Chapman, WAJ, Workshop Technology- Volume I, II, & III, Vima Books Pvt. Ltd., New Delhi.

Reference Books:

1. Singh, Swaran, Workshop Practice, S. K. Kataria and Sons, New Delhi.
2. Bawa, H.S., Workshop Practice, Tata McGraw Hill Publishers, New Delhi.
3. Bhati, J.P., Engineering Workshop, C.B.H. Publication, Jaipur

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weights (%)
1.	Engineering Workshop Practice assessment (May include Assignments//Quizzes/Tutorials/Lab Evaluations)	100

Semester II

AS7201- Mathematics – II

L	T	P	Cr
3	2	0	4.0

Course Objectives: To provide students with a clear understanding of the concepts of limits, continuity, differentiability, and integration, and to develop the analytical skills required to apply these concepts in solving problems encountered in engineering and technological applications.

Detailed Contents

Limits: Existence of limits, estimating limits numerically and graphically, limits of some standard functions, Infinite limits, limits at infinity and interpret them with respect to asymptotic behaviour.

Continuity: Continuity of functions and types of discontinuities.

Derivatives: Derivative of a function using the limit definition, derivatives of some standard functions, Rules of Derivatives, derivative as the slope of a tangent line to a graph, the slope of a graph at a point, and the rate of change of a dependent variable with respect to an independent variable, Mean value theorems.

Integration: Indefinite integral as inverse process of differentiation, Integration by substitution, integration by parts, and integration by using partial fraction decomposition, inverse trigonometric functions and their integration. **Definite Integrals:** Definite integrals and its properties, their applications to area, arc-length of planar curves in cartesian coordinate system.

Differential Equations: Definition, order, degree of ordinary differential equations, Formation of differential equation (upto 2nd order). Solution of Differential equations with Variable separation and Linear Differential equations.

Course Learning Outcomes (CLO):

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

1. Evaluate limits and examine continuity of functions and identify different types of discontinuities in mathematical models.
2. Compute derivatives using limit definitions and differentiation rules, and interpret derivatives as rates of change and slopes of tangent lines in engineering problems.
3. Evaluate indefinite and definite integrals using appropriate techniques such as substitution, integration by parts, partial fractions, and inverse trigonometric methods.
4. Apply appropriate analytical techniques to solve first-order ordinary differential equations, including variable separation and linear differential equation methods.

Text Books:

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
2. Mathematics, A Text book (Parts I & II), NCERT, New Delhi, 2011.
3. Thomas' Calculus, George B. Thomas, Pearson Education, 2014, 14th edition
4. Eagles(Applied Mathematics-II) by SS Sabharwal

Reference Books:

1. Schaum's Outline of Calculus Differential Equations by Shepley L. Ross
2. Differential Calculus by Shanti Narayan
3. Integral Calculus by Shanti Narayan
4. Differential Equations by D.S. Malik
5. Engineering Mathematics by H.K. Dass

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weights (%)
1.	MST	30
2.	EST	45
3.	Sessional (May include Assignments//Quizzes/Tutorials/Lab Evaluations)	25

AS7202- Chemistry

L	T	P	Cr
3	0	2	4.0

Course Objectives: The course aims at interpreting fundamental principles and recognizes the role of applied chemistry in water treatment, materials property and analytical techniques.

Detailed Contents

Electronic Structure of Atoms: Electromagnetic radiations, Wave-particle duality-DeBroglie's hypothesis, Heisenberg uncertainty principle, Quantum mechanical model of atom, Concepts of orbital and quantum numbers, Pauli's exclusion principle. Electronic configuration.

Chemical Bonding: Ionic and covalent compounds Weak bonding in chemical compounds, VSEPR model, Valence bond theory, Concept of hybridization.

Chemical Reactions: Principles and Types: Writing chemical equations, balancing reactions, types of reactions (acid-base, redox). Mole concept, mass relationships in reactions, calculating yields.

Water and Reactions in Aqueous Solution- Classification of water –soft water and hard water, action of soap on hard water, types of hardness, causes of hardness, disadvantages of hard water. Units of hardness, hard water and its removal and treatment processes-ion exchange &Permutit Process. Measuring the concentration in solutions: volumetric titration (acid-base, redox), Instrument based titrations (conductometry, and pH-metry).

Electrochemistry: Electronic concept redox reactions, Basic concept of electrolytes, non-electrolytes with suitable examples, Faraday's laws of electrolysis, Application of Electrolysis, concepts and types of cells, Lithium-ion battery.

Corrosion & Its Prevention: Theories of corrosion (chemical and electrochemical), factors affecting corrosion, and prevention methods like galvanisation, tinning, and cathodic protection.

Lubricants&Polymers: Definition of Lubricant and characteristics of good lubricant, physical &Chemical properties of lubricants.Classification of polymers, thermoplastics and thermosetting polymers, polymer average molecular weight, degree of polymerization, Properties and applications in diversified fields.

List of Experiments

1. Standardization of solutions (e.g., HCl or NaOH) and acid-base titrations
2. Estimation of total hardness of a water sample using the EDTA method.
3. Determination of solution pH using a pH meter.
4. Estimation of acid concentration or conductivity using conductometry.
5. Determination of viscosity of liquids/lubricants
6. Preparation of polymers like Bakelite or Nylon-6.
7. To find emf using Daniel Cell.
8. To find moisture and ash content in given coal sample.

Course Learning Outcomes (CLO):

After the completion of course the students will be able to understand following-

1. Electronic structure of atoms, chemical reaction, Periodic trends and Chemical bonding.
2. Distinguish types of hardness of water and its disadvantages, Recommend and apply various methods for removal of hardness.
3. Electrochemical reaction, working principle of cells, battery and their applications.
4. Polymerization reaction, molecular weight determination and applications of polymers
5. Explain the working mechanism of various cells, classify fuels and lubricants on basis of physical and chemical characteristics.
6. Laboratory techniques like pHmetry, conductometry and volumetry.

Text Books:

1. Ramesh, S. and Vairam S., Engineering Chemistry, Wiley India (2012) 1sted.
2. Puri, B. R., Sharma, L. R., and Pathania, M. S., Principles of Physical Chemistry, Vishal Publishing Co. (2008).
3. Aggarwal, S., Engineering Chemistry, Fundamentals and Applications, Cambridge University Press (2015).
4. Chopra, H. K. and Parmar, A., Engineering Chemistry. A Text Book”, Narosa Publishing House, New Delhi.

Reference Books:

1. Brown, H., Chemistry for Engineering Students, Thompson, 1sted
2. Sivasankar, B., Engineering Chemistry, Tata McGraw-Hill Pub. Co. Ltd, New Delhi (2008).
3. Shulz, M. J., Engineering Chemistry, CengageLearnings (2007) 1sted.
4. Jain, P. C. and Jain, M., Engineering Chemistry”, DhanapatRaiPublishingCompany, New Delhi.

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weights (%)
1.	MST	30
2.	EST	45
3.	Sessional (May include Assignments//Quizzes/Tutorials/Lab Evaluations)	25

AS7203- Electrical and Electronics Engineering

L	T	P	Cr
3	1	2	4.5

Course Objectives: This course will introduce fundamentals of electricity and concepts of DC and AC circuits. The fundamental theorems and their applications for electric circuits shall be introduced. Practical aspects of the subject will make the students capable of performing tests and experiments.

Detailed Contents

Fundamentals of Electricity: Introduction to electricity: charge, free electrons, electric potential and potential difference, electric current, electrical power and energy; meters used to measure electrical quantities. Coulomb's law. Advantages and applications of electrical energy. Concepts of resistance, conductivity and resistivity; laws of resistance; effect of temperature on resistance; temperature coefficient of resistance; colour coding of resistors. Basics of inductors and capacitors.

DC Circuits: Applications of Ohm's law with practical implementation. Types of DC circuits: series, parallel and series-parallel circuits. Applications of Kirchhoff's Laws (KVL and KCL). Definitions of nodes, branches and loops. Type of DC sources.

Batteries: Basic idea of primary and secondary cells. Concept of cell: definition, emf, internal resistance, terminal potential, types of cells (primary and secondary), grouping of cells (series, parallel and series-parallel). Working principle of lead-acid battery and its care and maintenance.

AC Fundamentals: Concept of alternating current and voltage. Difference between AC and DC. Equation of sinusoidal waveform for an alternating quantity. Concepts of cycle, frequency, time period and amplitude. Concepts of instantaneous value, RMS value, maximum value and average value. Form factor, peak factor and power factor. Concept of R-L-C series and parallel circuits.

Semiconductor Physics & Semiconductor Diode: Basic atomic structure, Concept of insulators, conductors and semiconductors, atomic structure of Germanium (Ge) and Silicon (Si). Concept to intrinsic and extrinsic semiconductor and types, process of doping, Energy level diagram of conductors, insulators and semiconductors; minority and majority charge carriers, Formation of P and N type semiconductors and their conductivity, effect of temperature on conductivity of intrinsic semiconductors. P-N Junction as a rectifier.

List of Experiments

1. Familiarization of meters: Use of analog and digital multimeter for measurement of voltage, current (A.C/D.C) and resistance etc. are resistances connected in parallel.
2. Measure the current drawn by the lamp at different voltages from zero to 220volts and the resistance of lamp at different voltages, plot a graph between current and voltage
3. Verify KVL and KCL in different circuits
4. Demonstration of parts of a battery and find the specific gravity of battery. Testing a

battery for its charged condition and to charge it and measure the terminal voltage during charging and discharging condition.

5. Operation and use of the following instruments: Voltmeter, Ammeter, Wattmeter, Multi-meter, CRO, Signal generator, LCR meter, Regulated Power Supply by way of taking readings of relevant quantities with their help.
6. Plotting of V-I characteristics of a PN junction diode
7. Plotting of V-I characteristics of a Zener diode.

Course Learning Outcomes (CLO):

After completing the course, the student should be able to:

1. Understand the fundamentals of electricity and associated terminologies.
2. Acquire knowledge of DC and AC circuits.
3. Illustrate the connection schemes of basic elements such as resistors, inductors and capacitors with DC/AC supply.
4. Understand the application of semiconducting material as a rectifier and amplifier.
5. Design the various configuration of bipolar transistors and OP-Amps.

Text Books:

1. Basic Electrical Engineering – V.K. Mehta
2. Basic Electrical Engineering – Nagrath & Kothari
3. Electrical Engineering Fundamentals – Vincent Del Toro
4. Fundamentals of Electrical Engineering – Rajendra Prasad

Reference Books:

1. Theraja, B.L. and A.K. Theraja, “ABC of Electrical Engineering”, S Chand Publishers, New Delhi.
2. Bhattacharya, S.K., “Basic Electrical and Electronics Engineering”, Pearson Education India.
3. Kothari, DP, and Nagrath, “Basic Electric Engineering”, Tata Mc Graw Hill.
4. Mittle, V., and Arvind Mittle, “Basic Electrical Engineering”, Mc Graw Hill Companies.

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weights (%)
1.	MST	30
2.	EST	45
3.	Sessional (May include Assignments//Quizzes/Tutorials/Lab Evaluations)	25

AS7204- Engineering Physics-II

L	T	P	Cr
3	1	2	4.5

Course Objectives: Engineering Physics serves to bridge the gap between basic scientific principles and advanced engineering technologies. This course focuses on wave mechanics, acoustics, optics, electricity, and the introduction of quantum mechanics to prepare students for specialized technical design and analysis.

Detailed Contents

Wave motion and Acoustics: Wave motion, transverse and longitudinal wave, Oscillations: Simple Harmonic Motion (SHM), expression for displacement, velocity, acceleration, time period, frequency, Free, damped, forced and resonant vibrations with examples, Ultrasonics: Production and Detection of Ultrasonic waves, Applications of ultrasonics. Acoustics of buildings, reverberation time, echo, noise, coefficient of absorption of sound, Sabine's and Eyring's formulae, Design and applications.

Optics: Laws of reflection and refraction, lens formula for thin lenses, power of lens, magnification, Total internal reflection and its applications, Critical angle and conditions for total internal reflection, Simple and compound microscope, astronomical telescope in normal adjustment, magnifying power, Interference, Young's double slit experiment and expression for fringe width, coherent sources and sustained interference of light, Interference by thin film, Diffraction due to a single slit, double slits and diffraction grating, Polarization: Production and detection of plane polarized light, Brewster's law, Malus Law, Applications.

Electrostatics: Coulomb's law, Electric field, Electric lines of force and their properties, Electric flux, Electric potential and potential difference, Capacitor and its working principle, Parallel plate capacitor, Series and parallel combination of capacitors, Dielectric and its effect on capacitance, dielectric break down.

Electricity & Magnetism: Electric current (DC and AC), resistance and conductance, Ohm's law, Kirchhoff's laws, Wheatstone bridge, and heating effect of current with electric power and energy, Magnetic fields and magnetic flux, magnetic materials (dia-, para-, and ferromagnetic), Fundamentals of electromagnetic induction: Faraday's and Lenz's laws, and working principles of a galvanometer.

List of Practicals

1. To find the time period of a simple pendulum/ compound pendulum
2. To verify laws of reflection from a plane mirror.
3. To find the focal length of the convex lens by lens formula.
4. To verify Ohm's law by plotting a graph between voltage and current.
5. To find resistance of galvanometer by half deflection method
6. To plot AC and DC waveforms using CRO.
7. To verify laws of resistances in series and parallel combinations.
8. To demonstrate Coulomb's Law: Pith Ball Experiment

Course Learning Outcomes (CLO):

After completing the course, the student should be able to:

1. Utilize Sabine's and Eyring's formulae to calculate reverberation time and design efficient building acoustics.
2. Apply principles of interference, diffraction, and polarization to explain the magnifying power of microscopes and telescopes.
3. Explain the principles of electric charges at rest, including Coulomb's Law, electric field intensity, electric potential, and the behavior of capacitors in electrical circuits.
4. Implement Kirchhoff's Laws and the Wheatstone bridge principle to measure electrical resistance and analyze AC/DC waveforms.
5. Demonstrate proficiency in laboratory techniques on relevant topics.

Text Books:

1. Ghatak, A.K., Optics, McGraw Hill (2024) 8th ed.
2. Beiser, A., Concept of Modern Physics, Tata McGraw Hill (2007) 6th ed.
3. Halliday, D., Resnick, R., and Walker, J., Fundamentals of Physics, Wiley India (2021) 12th ed.
4. Kinsler, L.E. and Frey, A.R., Fundamentals of Acoustics, John Wiley & Sons (2000) 4th ed.

Reference Books:

1. Bajaj, N.K., The Physics of Waves and Oscillations, Tata McGraw Hill (1988) 1st ed.
2. Gupta, A.B., Modern Acoustics, Books & Allied (2016) 1st ed.
3. Verma, N.K., Physics for Engineers, Prentice Hall of India (2014) 1st ed.
4. Pedrotti, Frank L., Pedrotti, Leno S., and Pedrotti, Leno M., Introduction to Optics, Pearson Prentice Hall™ (2008) 3rd ed.

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weights (%)
1.	MST	30
2.	EST	45
3.	Sessional (May include Assignments//Quizzes/Tutorials/Lab Evaluations)	25

AS7205- Communication Skills-II

L	T	P	Cr
2	0	2	3.0

Course Objectives: This course aims to develop advanced language proficiency and professional communication competence by integrating functional grammar, non-verbal and interpersonal communication, business communication skills, and critical reading, enabling learners to communicate effectively in academic, social, and workplace contexts.

Detailed Contents

Functional Grammar and Vocabulary: One word substitution, Prefixes and Suffixes, Punctuation, Narration, Idioms and Phrases

Basics of Communication: Introduction to channels of communication - formal (upward, downward, diagonal, horizontal), informal (grapevine, consensus), 7 Cs of Communication, Applicability of Johari Window for enhancing interpersonal communication skills.

Effective non-verbal communication: Meaning and Importance of Non-Verbal Communication, Different Types of Non-verbal Communication

Business Communication: Technical Report Writing, Designing Resumes and Cover Letters for effective job application, E-mail writing and e-mail etiquette, Agenda and Minutes of Meetings

Reading: The following text is required to be read by the students for Comprehension, Vocabulary enrichment and Grammar exercises: Animal Farm by George Orwell

List of Practical Activities

1. Group discussion on some current topic of interest.
2. Small speech using voice modulation.
3. Debate
4. Manners and Etiquette
5. PowerPoint presentation.
6. Mock interviews

Course Learning Outcomes (CLO):

Upon completion of this course, students will be able to:

1. Apply advanced grammar and vocabulary to produce clear and correct written and spoken communication.
2. Analyse communication channels and models to improve interpersonal and organizational communication.
3. Demonstrate effective non-verbal communication in academic and professional

interactions.

4. Create professional business documents such as reports, resumes, emails, and meeting records.
5. Critically analyze literary texts to enhance comprehension, vocabulary, and language proficiency.

Reference Books:

1. Revathi, Srinivas, "Communicating Effectively in English, Book-1", Abhishek Publications, Chandigarh.
2. Mohan, Krishna & Meera Banerji, "Developing Communication Skills (2nd Edition)", Published by Macmillan Publishers India Ltd; New Delhi.
3. Eastwood, John, "Oxford Practice Grammar", Oxford University Press, London
4. Chadha, R. K., "Communication Techniques and Skills", Dhanpat Rai Publications, New Delhi.
5. Wren & Martin, "High School English Grammar and Composition", S. Chand & Company Ltd., Delhi.
6. Kumar, Sanjay & Pushp Lata, "Communication Skills", Oxford University Press, New Delhi

Websites for Reference

- [http://www.mindtools.com/ page 8.html](http://www.mindtools.com/page 8.html)
- <http://www.letstalk.com.in>
- <http://www.englishlearning.com>
- <http://learnenglish.britishcouncil.org/en/>

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weights (%)
1.	MST	30
2.	EST	45
3.	Sessional (May include Assignments//Quizzes/Tutorials/Lab Evaluations)	25

AS7206-Programming In C

L	T	P	Cr
3	0	2	4.0

Course Objectives: This course aims to develop an understanding of computer fundamentals and problem-solving skills through C programming, enabling students to design and implement solutions for real-life applications.

Detailed Contents

Problem solving and Algorithms: Algorithm, Flowchart, Formulate simple algorithms for logical and arithmetic problems, Generation of Programming Languages.

Basics of C Programming: Structure and Life cycle of a C Program, Data types, Identifiers, Variables, Keywords, Constants, input/output statements, Operators, Type conversion and type casting. Decision Making, Iterative Statements and Nested loops.

Functions: Function prototype, Definition and Call, Scope of variables, Storage classes, Recursive functions, Recursion Vs Iteration.

Arrays and Strings: One-dimensional array and its operations (Traversal, Linear Search, Insertion, Deletion etc.), Two-dimensional and its operations, Passing of array into a function, Input and output of a string, string inbuilt functions.

Structures and Union: Structure declaration, Initialization of structures, Structure variables, Accessing structure elements, Passing structure variable to a function, Structure pointer, Comparison of Structure and Union.

List of Experiments

1. Programming exercises on executing and editing a C program.
2. Programming exercises on defining variables and assigning values to variables.
3. Programming exercises on arithmetic and relational operators.
4. Programming exercises on arithmetic expressions and their evaluation.
5. Programming exercises on formatting input/output using printf and scanf and their return type values.
6. Programming exercises using if, if else, switch, while and for statement.
7. Programs on one-& two-dimensional array.
8. (i) Programs for putting two strings together. (ii) Programs for comparing two strings.
9. Simple programs using structures & union.
10. Write a program to apply open, close and save operations on a file to be performed on C file.
11. Program to perform write and read operations in file.

Course Learning Outcomes (CLO):

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

1. Comprehend and analyze the concepts of number system, memory, compilation and debugging of the programs in C language.
2. Apply decision-making and iterative statements to solve programming problems using C language.

Text Books:

1. C Programming Language, Brian W. Kernighan, Dennis M. Ritchie, 2nded, 2012.
2. Programming in ANSI C, Balagurusamy G., 8thed., 2019

Reference Books:

1. Let Us C, Kanetkar Y., 16th ed., 2017

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weights (%)
1.	MST	30
2.	EST	45
3.	Sessional (May include Assignments//Quizzes/Tutorials/Lab Evaluations)	25

AS7207- Environmental Studies

L	T	P	Cr
1	0	0	1.0

Course Objectives: Engineering activities require the use of natural resources which results in wide-ranging adverse effects on the environment. Natural replenishment of these resources is practically impossible. These necessities that all technicians should know about the basics of ecology, environment and its functions, environmental pollution & management and environmental legislation which will enable them to accomplish their professional work with environmental compatibility.

Detailed Contents

Introduction: Basics of Ecology, Ecosystem and Environment, Biogeochemical Cycles, Desertification, Rainwater Harvesting and Groundwater Management, Deforestation, Sustainable Development, Green Building and Eco-Friendly Materials.

Water Pollution: Introduction to water pollution, sources, causes, effects and control of water pollution, wastewater, Water Pollutants, BOD, COD, Measurement Techniques-Water Pollution Control Equipment & Instruments, Concept of Zero Liquid Discharge.

Air Pollution: Introduction to Air Pollution, Sources, causes, effects and control of air pollution, Air Quality Index (AQI), Indoor air pollution, ambient air quality, vehicular emission and its prevention, global warming, acid rain, greenhouse effect, depletion of ozone layer

Solid Waste management: Introduction, Classification of refuse material, sources, effects and control measure of solid waste. Waste Minimization Techniques.

Environmental Legislation: Introduction to Water (prevention and control of pollution) Act, Air (Prevention and Control of Pollution) Act and Environmental Protection Act, Solid Waste Management Rules and its amendments, Plastic Waste Management Rules, E-waste Management Rules, Role and Function of State Pollution Control Board, Concept of Environmental Impact Assessment (EIA)

Energy Management: Introduction to Energy Conservation, Energy efficiency and its need. Role of Non-conventional Energy Resources (Solar Energy, Wind Energy, Bio mass energy, hydro energy) in environmental protection.

Course Learning Outcomes (CLO):

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

1. Comprehend the importance of ecosystem and demonstrate interdisciplinary nature of environmental issues.
2. Identify different types of environmental pollution and control measures.
3. Compute the impact of human activities on the environment.
4. Take corrective measures for the abatement of environmental pollutions.
5. Understand purpose of environmental legislation acts.
6. Define energy management, energy conservation and energy efficiency
7. Identify the role of non-conventional energy resources in environmental protection.

8. Adopt cleaner productive technologies for sustainable development.

Text Books:

1. Moaveni, S., Energy, Environment and Sustainability, Cengage.
2. Sharma, BR, “Environmental and Pollution Awareness”, Satya Prakashan, New Delhi.

Reference Books:

1. Khitoliya, Dr. RK, “Environmental Pollution”, S Chand Publishing, New Delhi.
2. Rai, G.D. Non-conventional Energy Resources, Khanna Publishers. Bharucha, Erach, “Environmental Studies”, University Press (India) Private Ltd., Hyderabad.
3. Dhamija, Suresh K, “Environmental Engineering and Management”, SK Kataria and Sons, New Delhi.
4. Environmental Pollution Control Engineering by C.S. Rao (4th Ed).

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weights (%)
1.	MST	30
2.	EST	45
3.	Sessional (May include Assignments//Quizzes/Tutorials/Lab Evaluations)	25