Far Western University
Faculty of Engineering

Course Title:	Engineering Math	Course Code:	SH1101
Course Credit:	3 (3-1-0)	Year/Semester:	I/I
Level:	Undergraduate	Program:	Civil Engineering

Course Description

This course introduces the fundamental concepts of differential and integral calculus, differential equations, and analytic geometry with applications in civil engineering. It focuses on developing problem-solving skills through derivatives, and integrals, along with coordinate transformations and conic sections. Emphasis will be given on practical applications such as use of curvature in road design and the use of integrals in determining hydrostatic forces and pressures.

General Objectives

- The course aims to develop students' understanding of calculus, differential equations, and analytic geometry, with emphasis on applications in civil engineering.
- It seeks to enhance problem-solving and analytical skills while connecting mathematical theory to practical engineering scenarios.
- By the end of the course, students will be able to apply mathematical techniques effectively in solving engineering problems.

Learning Outcomes

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

LO 1: apply concepts of differentiation and integration to solve engineering problems involving rates of change, areas, volumes, and physical quantities such as pressure and force.

LO 2: develop skills in solving various types of ordinary differential equations and apply them to solve and model various problems in physical sciences and engineering systems.

LO 3: analyze and interpret the geometric properties of curves by using derivatives to determine tangents, asymptotes, curvature, and radius of curvature, with practical applications in road and structural design

LO 4: understand and use the concept of analytic geometry to represent and interpret the equations of straight lines, conic sections, and their transformations in the plane.

LO 5: visualize and solve problems involving three-dimensional geometry, including lines, planes, spheres, cylinders, and cones, for applications in spatial analysis and engineering design.

Contents

Learning Objectives	Content	Hrs.
LO 1 and LO 3	**Unit 1: Derivatives and its Applications** 1.1 Review of concept, interpretation and rules of differentiation 1.2 Rolle's theorem, Lagrange's mean value theorem (Statement, interpretation and applications), Taylor series and Maclaurin series 1.3 Indeterminate forms, L-Hospital Rule 1.4 Asymptotes to Cartesian curves and polar curves 1.5 Pedal equations to Cartesian and polar curves 1.6 Curvature and radius of curvature for Cartesian curves, application in road design	10
LO 1	**Unit 2: Integration and its Applications** 2.1 Review of basic integration techniques 2.2 Definite integral and properties 2.3 Improper Integrals 2.4 Beta and Gamma functions 2.5 Determination of area, length, volume and surface area of solid of revolution for Cartesian curves in plane 2.6 Application of integrals to find hydrostatic force and pressure	10
LO 2	**Unit 3: Ordinary differential Equation and its Applications** 3.1 Review of solution of first order first degree equations using the variable separable method, method of homogenous differential equations 3.2 Solution of linear first order differential and Bernoulli's equation. Application in physical sciences and engineering 3.3 Equation of first order and higher degree equation, Clairaut's form 3.4 Solution of second order and first degree equation with constant and variable coefficients 3.5 Application of second order equations in physical sciences and engineering.	12
LO 4	**Unit 4: Plane Analytic Geometry** 4.1 Transformation of coordinates: Translation and rotation 4.2 Equation of Conics in Cartesian and polar curves, identification of conics	4
LO 5	**Unit 5: Three Dimensional Geometry** 5.1 The straight line in symmetrical form 5.2 Coplanar lines and shortest distance 5.3 Sphere: General equation and section by planes 5.4 Basics of right circular cylinder and right circular cone	9

Reference books

1. Kreyszig , A. , *Advanced engineering Mathematics*, 10th Edition
2 James Stewart, *Calculus: Early Transcendentals*, 8th edition, Cengage Learning
3. Sastry S.S. , *Engineering Mathematics vol I and II*, Prentice Hall of India
4. Parajuli, V., Ghimire, S. and et al, *A Course Book on Engineering Mathematics- I*, Asmita Publication.

Method of Instruction

Lecture and Tutorial

Tutorial

There shall be related tutorials exercised in class and given as regular homework exercise. Tutorial can be as following for each specified chapters

1. Derivatives and its Applications
2. Antiderivatives and its Applications
3. Ordinary Differential Equations and its Applications
4. Plane Analytic Geometry
5. Three dimensional geometry

Evaluation Approach

Performance of the students will be evaluated in two phases: Internal assessment and the semester-end examination. To be eligible for the semester-end examination, a student must successfully pass the internal evaluation. The internal evaluation will be carried out as a continuous assessment process throughout the semester which includes a range of assessment components designed to measure both theoretical understanding and practical applications. The evaluation includes unit tests, midterm exams take-home assignments, class tests, quizzes, mini projects, and presentations. The semester-end examination will be a comprehensive written test which is designed to assess students' overall conceptual grasp, analytical thinking, and problem-solving skills developed throughout the course.

Evaluation	**Marks**	**Approach**	**Marks**
Internal evaluation (Theory)	40 Marks	Assignment/Tutorial	8
		Attendance	4
		Quizzes	4
		Presentation/Class Performance	4
		Unit Tests/ Internal Assessments	20
Semester End Examination	60 Marks		60
	Total		**100**

Marks Distribution for End Semester Examination

Chapters/Units	**Hours Allocated**	**Marks Distribution (Tentative)***
Unit I	10	13.5

Unit II	10	13.5
Unit III	12	16
Unit IV	4	5
Unit V	9	12
Total	**45**	60

* There may be minor deviation in marks distribution.

Far Western University
Faculty of Engineering

Course Title:	Engineering Physics	Course Code:	SH 1102
Course Credit:	3 (3-1-1.5)	Year/Semester:	I/I
Level:	Undergraduate	Program:	Civil Engineering

Course Description

This course intends to enable the students to be acquainted with the basic concepts and principles of physics in the field of engineering. Students will be familiarized with the mechanical oscillations, physical optics, geometrical optics, electrostatics, electromagnetic induction, Maxwell's equations, electromagnetic waves, matter waves, general concepts of heat and thermodynamics. The background of physics corresponding to Higher Secondary Level is assumed.

General Objectives

At the end of this course students should be able:

- To acquire basic concept and knowledge in physics.
- To apply this knowledge as base for studying major courses.
- To introduce the concepts and methods of mechanics, optics, electrostatics, electromagnetism, heat and thermodynamics needed for application in various areas.

Contents

Learning Outcomes	Content	Hrs.
• Understand the types of oscillation • Know the concept of resonance and its uses in the field of engineering • Built problem solving skill	**Unit 1: Oscillation** 1.1 Introduction 1.2 Types of mechanical oscillation (free, damped and forced) 1.3 Examples of free oscillation: Physical and Torsion pendulum 1.4 Relaxation time, quality factor and sharpness of resonance	4
• Know the concept for designing of sound proof structure • Understand the basic concept of ultrasound	**Unit 2: Sound and its Application** 2.1 Introduction, Acoustics of building 2.2 Reverberation, absorption coefficient, Sabine relation 2.3 Ultrasound: Introduction, Production (Piezo-electric) and uses	3
	Unit 3: Optics	13

• Understand the interference and formation of maxima, minima • Able to know the newton's rings pattern • Understand the difference between interference and diffraction • Understand the energy distribution in a single slit diffraction • Understand the uses of x-ray in crystallography • Using the knowledge of double refraction and know the role of retardation plate • Understand the principles of laser and its application • Know the principles and uses of optical fiber • Know the combination of lens, cardinal points and chromatic aberration	3.1 Interference: Introduction, interference in thin films, wedge shaped films, Newton's rings 3.2 Diffraction: Introduction and types, diffraction from a single slit, diffraction grating, X-ray diffraction and its uses 3.3 Polarization: Double refraction, Nicol prism, retardation plates (half and quarter wave plate), optical activity and specific rotation 3.4 Laser and Fiber optics: Principles and uses of laser, He-Ne laser, optical fiber (Propagation, types and uses) 3.5 Combination of lenses, cardinal points, chromatic aberration and its removal (contact and separation in finite distance by calculus method)	
• Understand the concept of electric field and potential • Able to calculate the field and potential for point charge and continuous charge distribution • Understand the principle of capacitor and role of dielectrics • Know the concept of time constant in charging and discharging of capacitor	**Unit 4: Electrostatics** 4.1 Electric field: electric field due to electric dipole (at axial and equatorial point), field due to quadrupole on axial line, electric field due to charged ring and disk on axis, equipotential surface 4.2 Electric potential: potential due to dipole at any point, potential due to quadrupole at axial line, potential due to charged ring and disc on axis, relation between field and potential 4.3 Capacitor: Cylindrical capacitor, energy stored in capacitor and electric energy density, charging and discharging of capacitor, capacitor with dielectrics: dielectrics and Gauss law	6
• Understand the microscopic view of Ohm's law • Know the difference between semiconductor and superconductors	**Unit 5: Electromagnetism** 5.1 Ohm's law: microscopic view and resistivity 5.2 Semiconductors and superconductors 5.3 Circulating charges: Cyclotron 5.4 Faraday's laws, induction and energy transformation, self-induction and mutual induction, energy stored in a	9

• Know the concept of charge particles in magnetic field • Understand the electromagnetic induction, self-induction and mutual induction • Understand the concept of displacement current • Able to convert Maxwell's equations from integral to differential form and know the charge conservation theorem.	magnetic field and energy density, induced magnetic field, modified Ampere's law and displacement current 5.5 Maxwell's equations: Integral and differential form, continuity equation	
• Understand the reason behind the development of wave mechanics • Know the concept of de-Broglie wavelength and wave particle duality • Know the concept of wave functions & its significance • Understand Schrodinger wave equation and its application for energy quantization and tunnel effect.	**Unit 6: Matter waves** 6.1 Inadequacy of classical mechanics, development of quantum mechanics, quantization of energy, group velocity and phase velocity, de-Broglie wavelength, Heisenberg uncertainty principle, Wave functions and its significance 6.2 Time-independent and time-dependent Schrodinger wave equations 6.3 One dimensional infinite potential well, barriers tunneling	4
• Acquainted with the laws of thermodynamics and applications • Know the concepts of heat transfer in building science	**Unit 7: Heat and thermodynamics** 7.1 Concepts and definition 7.2 Laws of thermodynamics: first law, internal energy, Joules law, enthalpy, specific heat, application of first law for closed system, second law of thermodynamics, heat engine, Kelvin-Planck and Clausius statement of second law, entropy and third law of thermodynamics 7.3 Heat Transfer: Fourier's law of thermal conductivity, use of thermal conductivity in building sciences, thermal resistance, types of convection (Natural and Forced convection), radiation, relation between Stefan's law and Newton's law of Cooling	6

Reference books

1. Halliday, Resnick, Walker (2016), "*Fundamental of Physics"*, John Wiley & Sons. Inc.
2. Brij Lal and N. Subrahmanyam, Latest edition, "*A Text Book of Optics*", S. Chand Pub.
3. Brij Lal and N. Subrahmanyam, (2001), "*Heat and Thermodynamics*", S. Chand Pub.
4. Pokharel, Bhattarai and Paudel, (2024, third edition), *"Fundamental of Engineering Physics",* Bechmark Publication.
5. Brij Lal and N. Subrahmanyam, Latest edition, "*Waves and Oscillation*", S. Chand Pub.
6. Basudeva, A. S., Latest edition "*Modern Engineering Physics*", S. Chand Pub.
7. R. K. Gaur and S. L. Gupta, (1993), *"Engineering Physics"*, Dhanpat Rai Pblisher.

Method of Instruction

Lecture, Lab and Tutorial

Laboratory Works

1. To determine the acceleration due to gravity and radius of gyration of the given metal bar using bar pendulum.
2. To determine the modulus of elasticity of the given material and moment of inertia of the circular disc about the wire as an axis passing through its center and perpendicular to its plane by using torsional pendulum.
3. To determine the coefficient of thermal conductivity of a bad conductor by Lee's method.
4. To determine the mechanical equivalent of heat by given method.
5. To determine the wavelength of sodium light by using Newton's rings.
6. To determine the wavelength of sodium light by using wedge-shaped method.
7. To determine the wavelength of laser light using diffraction grating and hence determine the thickness of hair.
8. To determine the focal length of two lenses when they are separated by some finite distance.
9. To determine the chromatic aberration of a convex lens between red and blue colors.
10. To determine the capacitance of given capacitor by the method of charging and discharging through a resistor.
11. To plot the graph between frequency and current in series LCR circuit and hence determine the quality factor of the circuit.
12. To determine the specific rotation of sugar solution using polarimeter.
13. To determine the dielectric constant of the given material.

Evaluation Approach

The evaluation of student performance shall be conducted in two distinct phases: Internal (Continuous) Assessment and Semester-End Examination. Student must pass the internal evaluation to qualify for the semester-end examination.

The Internal Evaluation will be carried out as a continuous assessment (CA) process throughout the semester. It will include a range of formative assessment components designed to measure both theoretical understanding and practical competence. The evaluation modalities may comprise unit tests, take-home assignments, class tests, quizzes, report, and viva-voce examinations, as deemed appropriate by the instructor.

The Semester-End Examination shall be a comprehensive written examination, aimed at evaluating the students' overall conceptual understanding, analytical ability, and problem-solving skills acquired during the course.

Evaluation	**Marks**	**Approach**	**Marks**
Internal evaluation (Theory)	40 Marks	Assignment/Tutorial	8
		Attendance	4
		Quizzes	4
		Presentation/Class Performance	4
		Unit Tests/ Internal Assessments	20
Practical Examination	10 Marks (Internal)	Practical Report	8
		Attendance	2
	15 Marks (External)	Practical Exam	10
		Viva	5
Semester End Examination	60 Marks		60
	Total		**125**

Marks Distribution for End Semester Examination

Chapters/Units	**Hours Allocated**	**Marks Distribution (Tentative)***
Unit I	4	5
Unit II	3	4
Unit III	13	18
Unit IV	6	8
Unit V	9	12
Unit VI	4	5
Unit VII	6	8
Total	**45**	60

* There may be minor deviation in marks distribution.

Far Western University
Faculty of Engineering

Course Title:	Basic Electrical and Electronics Engineering	Course Code:	EX 1103
Course Credit:	3 (3-1-1.5)	Year/Semester:	I/I
Level:	Undergraduate	Program:	Civil Engineering

Course Description

This course introduces students to the fundamental concept of electrical and electronics engineering. It emphasizes analog and digital electronics and electric machines. Through lectures and lab experiments, students will learn the concept to analyze DC/AC electric circuits, analog and digital devices, instrumentation and wiring system along with their practical applications.

General Objectives

- provide a foundation in electrical technology and covers topics in basic direct current (DC) and Alternating Current (AC) circuit analysis, transformers and electrical machines.
- provide students with basic knowledge of analog and digital electronic devices.
- Acquaint students with the measurement and instrumentation in data acquisition system.
- provide the concept of electrical AC/DC analysis circuits, basic electronic devices and wiring system.

Learning Outcome

After completing this course, students will be able to:
LO 1: analyze DC/AC circuits and determine current and voltages in those circuits.
LO 2: apply Ohm's law and Kirchhoff's laws to evaluate current and voltage in different circuits.
LO 3: determine the relationship between voltage, current and power in AC/DC electric circuits.
LO 4: understand the working and construction of motor, generator and transformer with their applications.
LO 5: determine the output characteristics of semiconductors devices (diode and transistors)
LO 6: implement op-amp as an amplifier.
LO 7: verify the operation of logic gates and realize the Boolean expression.
LO8: understand the instrumentation system, sensor and transducer with their applications.
LO 9: understand the concept of basic electrical wiring and its accessories.

Content

Learning Objectives	Content	Hrs.
LO 1, LO 2, LO 3	**Unit 1: DC Circuit Analysis** 1.1 Resistors: characteristics (value, power rating, codes, tolerances) 1.2 current, voltage, power relationships, temperature coefficient, equivalent resistance in parallel and series connection 1.3 Capacitors and Inductors 1.4 Kirchhoff's current and voltage laws 1.5 Voltage divider and current divider rule 1.6 Thevenin and Superposition Theorem	8
LO 1, LO 3	**Unit 2: AC Circuit Analysis** 2.1 Generation of Alternating Current (AC) voltage, definition of basic terms of AC waveform, average, and RMS value of AC waveform 2.2 Impedance, admittance, reactance 2.3 Real power, reactive power and apparent power, power factor 2.4 Series and parallel AC circuits 2.5 Single and three phase AC systems.	8
LO 4	**Unit 3: Introduction to Transformer and Electrical Machines** 3.1 Single phase transformers: construction and operation of ideal transformer, voltage and current relationship 3.2 Types of practical transformers 3.3 DC generators and motors: working principles and Applications 3.4 AC generators and motors: working principles and applications	6
LO 2, LO 4	**Unit 4: Semiconductors** 4.1 P and N Type materials 4.2 PN Junction Diode 4.3 Rectifiers 4.4 Special diodes (Zener, LED) and their applications	4
LO 5, LO 6	**Unit 5: Bipolar Junction Transistor(BJT) and Metal Oxide Field Effect Transistor (MOSFET)** 5.1 BJT construction, operation and characteristics	5

	5.2 Applications of BJT (as a Switch and amplifier) 5.3 MOSFET construction, operation and applications 5.4 Operational Amplifier, characteristics and applications	
LO 7	**Unit 6: Digital Electronics** 6.1 Logic gates (AND, OR, NOT, NAND, NOR, XOR) and their truth tables 6.2 Boolean function realization and its practical application 6.3 Difference between Combinational and Sequential Circuits, Examples	4
LO 8	**Unit 7: Measurement and Instrumentation** 7.1 Ammeter, Voltmeter, Ohmmeter, Wattmeter and Energy Meter 7.2 Digital Voltmeter 7.3 Sensors and transducers and their applications 7.4 Introduction to analog and digital Data Acquisition System and data logging system	6
LO 9	**Unit 8: Fundamentals of Wiring** 8.1 Basics of residential, commercial and industrial electricity supply system 8.2 Basic concept of wiring and types of wiring 8.3 Circuit Breakers and MCB 8.4 Electrical Safety Rules and Practices 8.5 Earthing and Grounding	4

Reference books

1. S. K. Bhattacharya, “Basic Electrical and Electronics Engineering”, Pearson India
2. R. Boylestad, L. Nashelsky, “Electronic Devices & Circuit Theory”, PHI
3. R. L. Boylestad, “Introductory Circuit Analysis”, PHI
4. A. P. Malvino; D. P. Leach, “Digital Principles and Applications”, Mc Graw Hill
5. D. Helfric and W. D. Cooper, “Modern Electronic Instrumentation and Measurement Techniques”, PHI
6. W.E Steward and Tim Stubbs, “Modern Wiring Practice Design and Installation”, Newnes

Method of Instruction

Lecture, Lab and Tutorial

Laboratory Works

The laboratory component reinforces theoretical learning through hands-on experience. Students will learn to:

- Measure voltage, current and power in an electric circuit.
- Measure amplitude, frequency and time period using oscilloscope.
- Rectify signals using half and full wave rectifiers.
- Verify the operation of basic logic gates.
- Plot the characteristic of diode and transistor.

Generic Laboratory Topics

- Familiarization with passive components, function generator and oscilloscope
- Measurement of voltage, current & power in DC circuit
- Verification of Ohm's Law and Kirchhoff's voltage & current Law
- Measurement of amplitude, frequency and time period using oscilloscope
- AC power measurement
- Familiarization with three-phase AC circuits
- Diode characteristics
- Rectify AC signals using half-wave and full wave rectifier
- Obtain input and output characteristics of transistor
- Voltage amplifiers using op-amp
- Verification of logic gates
- Familiarization with temperature sensor/strain gauge
- Familiarization with Wiring using lamp, switches and a power socket

Evaluation Approach

The evaluation of student performance shall be conducted in two distinct phases: Internal (Continuous) Assessment and Semester-End Examination. Student must pass the internal evaluation to qualify for the semester-end examination.

The Internal Evaluation will be carried out as a continuous assessment (CA) process throughout the semester. It will include a range of formative assessment components designed to measure both theoretical understanding and practical competence. The evaluation modalities may comprise unit tests, take-home assignments, class tests, quizzes, presentations, and viva-voce examinations, as deemed appropriate by the instructor.

The Semester-End Examination shall be a comprehensive written examination, aimed at evaluating the students' overall conceptual understanding, analytical ability, and problem-solving skills acquired during the course.

Evaluation	**Marks**	**Approach**	**Marks**
Internal evaluation (Theory)	40 Marks	Assignment/Tutorial	8
		Attendance	4
		Quizzes	4
		Presentation/Class Performance	4
		Unit Tests/ Internal Assessments	20
Practical Examination	10 Marks (Internal)	Practical Report	8
		Attendance	2
	15 Marks (External)	Practical Exam	10
		Viva	5
Semester End Examination	60 Marks		60
	Total		**125**

Marks Distribution for End Semester Examination

Chapters/Units	**Hours Allocated**	**Marks Distribution (Tentative)***
Unit I	8	11
Unit II	8	11
Unit III	6	8
Unit IV	4	5
Unit V	5	7
Unit VI	4	5
Unit VII	6	8
Unit VIII	4	5
Total	**45**	60

* There may be minor deviation in marks distribution.

Far Western University

Faculty of Engineering

Course Title:	Applied Mechanics	Course Code:	CE1104
Course Credit:	3 (3-2-0)	Year/Semester:	I/I
Level:	Undergraduate	Program:	Civil Engineering

Course Description:

The course is aimed to prepare students for understanding the fundamentals of Engineering mechanics. Applied Mechanics, often referred to as Engineering Mechanics, is the study of the response of bodies (rigid and deformable) with its more focus on rigid bodies and systems of rigid bodies to external forces. This course provides students with the fundamental principles of Statics and Dynamics, which are essential prerequisites for subsequent courses in structural analysis, fluid mechanics, and design of infrastructures. The focus will be on applying Newtonian laws of mechanics to analyze forces, equilibrium, and motion of engineering components relevant to civil infrastructures.

General Objectives

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

1. Develop a strong foundation in the principles of rigid body mechanics.
2. Analyze force systems and determine their resultants on engineering structures.
3. Apply the conditions of static equilibrium to solve for unknown forces and reactions in structures like trusses and beams.
4. Determine the geometric properties of areas, such as centroids and moments of inertia, which are crucial for stress analysis.
5. Understand the principles of friction and its role in mechanical systems and structural connections.
6. Analyze the kinematics and kinetics of particles and rigid bodies under the action of forces.

Learning Outcomes

After completing this course, students will be able to:

- **LO1:** Draw accurate Free Body Diagrams (FBDs) for various engineering components and apply the equations of static equilibrium (2D and 3D) to solve for support reactions and internal forces.
- **LO2:** Calculate the resultant of different force systems (concurrent, parallel, and general) using scalar and vector methods.
- **LO3:** Solve engineering problems involving different types of friction (static and kinetic).
- **LO4:** Compute the Axial Force, Shear Force, and Bending Moment for statically determinate beams and frames and draw their diagrams.
- **LO5:** Analyze plane trusses using the method of joints and the method of sections.
- **LO6:** Locate the centroid and calculate the moment of inertia for simple and composite areas.
- **LO7:** Apply the principles of kinematics (displacement, velocity, acceleration) and kinetics (Newton's Second Law, work-energy, impulse-momentum) to particle and rigid body motion.

Content

Learning Objectives	Content	Hrs.
LO 1	**Unit 1: Basic Concept of Engineering Mechanics and Static Equilibrium** 1.1 Definitions, types and scope of mechanics 1.2 Fundamental concepts and principles of engineering mechanics 1.3 Concept of particle, rigid body and deformable body 1.4 Physical meaning of equilibrium and its essence in structural application 1.5 Equations of equilibrium in plane and space for the analysis of particle and rigid body 1.6 Concept of free body diagram with its application and examples	4
LO 2	**Unit 2: Forces Acting on Particle and Rigid Body** 2.1 Different types of forces: Internal/external force, adhesive/ cohesive force, point/ line/ surface force and contact/ body force 2.2 Resolution and composition of forces 2.3 Principle of transmissibility and equivalent forces 2.4 Varignon's theorem and its application 2.5 Moments of a force about a point and about an axis 2.6 Definition, types and characteristics of couple 2.7 Resolution of a force into a force and a couple 2.8 Resultant of force and moment for a system: Coplanar, concurrent and general force system 2.9 Concept and formation of wrench (Force and couple lying on a single plane)	7
LO 1, LO 3	**Unit 3: Friction** 3.1 Definition, types and uses of friction, laws of friction, static and dynamic coefficient of friction, angle of friction 3.2 Sliding and overturning condition of a body 3.3 Concept and working principle of jackscrew 3.4 Practical examples of dry friction (Ladder and Wedge friction)	2
LO 1, LO 2, LO 4	**Unit 4: Analysis of Simple Beams and Frames** 4.1 Introduction to structures and their forms 4.2 Various types of load on the structure 4.3 Various types of supports; Reactions and degree of freedom 4.4 Internal and external forces in the structure 4.5 Relationship between load, shear force and bending moment 4.6 Statically and geometrically stable/ unstable beams and frames 4.7 Statically determinate and indeterminate beams and frames, degree of static indeterminacy 4.8 Axial force, shear force and bending moment diagrams for determinate beams and frames	8
LO 1, LO 2, LO 5	**Unit 5: Analysis of Plane Trusses** 5.1 Definition of truss, assumption of ideal truss, types and uses of truss in engineering	4

	5.2 Statically and geometrically stable and unstable truss 5.3 Statically determinate and indeterminate truss, degree of static indeterminacy 5.4 Analysis of truss by the method of joint and section/ moment	
LO 2, LO 6	**Unit 6: Centre of Gravity, Centroid, Moment of Inertia, and Mass Moment of Inertia** 6.1 Concepts of centre of gravity and centroid of line, area and volume 6.2 Second moment of area/moment of inertia and radius of gyration 6.3 Perpendicular and parallel axis theorem for moment of inertia and their appllication 6.4 Concept of mass moment of inertia with is application	6
LO 7	**Unit 7: Kinematics of Particles (Rectilinear and Curvilinear Motion)** 7.1 Position, velocity and acceleration of a particle for rectilinear motion 7.2 Dependent and relative motion of particles 7.3 Position, velocity and acceleration of a particle for curvilinear motion 7.4 Projectile motion 7.5 Tangential and normal components of velocity and acceleration 7.6 Radial and transverse components of velocity and acceleration	5
LO 1, LO 2, LO 7	**Unit 8: Kinetics of Particles: Force, Acceleration, Energy and Momentum** 8.1 Newton's second law of motion, linear momentum and impulsive motion 8.2 Equation of motion and dynamic equilibrium 8.3 Angular momentum and rate of change of angular momentum 8.4 Equation of motion for rectilinear and curvilinear motion (Rectangular components, tangential and normal components and radial and transverse components) of particle 8.5 Work and energy principle 8.6 Principle of conservation of energy, concept of conservative and non-conservative system 8.7 Definition and types of impact	4
LO 4	**Unit 9: Kinematics and Kinetics of Rigid Body in Plane Motion, Energy and Momentum Methods** 9.1 Translation, rotation and general plane motion 9.2 Absolute and relative velocity in plane motion 9.3 Instantaneous centre of rotation 9.4 Equation of motion: D'Alembert's principle 9.5 Angular momentum of rigid body 9.6 Principle of work and energy for a rigid body 9.7 Kinetic energy for a rigid body	5

Reference books

1. Beer, F. P., Johnston, E. R. (2019). Vector Mechanics for Engineers: Statics and Dynamics (12th ed.). McGraw-Hill Education.
2. Hibbeler, R. C., Gupta, A. (2024). Engineering Mechanics: Statics and Dynamics (14th ed.). Pearson. Jong, I. C., Rogers, B. G. (1995). Engineering Mechanics: Statics and Dynamics. Oxford University Press.
3. Shames, I. H. (1996). Engineering Mechanics: Statics and Dynamics (4th ed.). Prentice Hall of India.
4. Popov, E. P. (1990). Engineering mechanics of solids. Prentice Hal

Method of Instruction

Lecture and Tutorial

Evaluation Approach

The evaluation of student performance shall be conducted in two distinct phases: Internal (Continuous) Assessment and Semester-End Examination. Student must pass the internal evaluation to qualify for the semester-end examination.

The Internal Evaluation will be carried out as a continuous assessment (CA) process throughout the semester. It will include a range of formative assessment components designed to measure both theoretical understanding and practical competence. The evaluation modalities may comprise unit tests, take-home assignments, class tests, quizzes, mini projects, presentations, and viva-voce examinations, as deemed appropriate by the instructor.

The Semester-End Examination shall be a comprehensive written examination, aimed at evaluating the students' overall conceptual understanding, analytical ability, and problem-solving skills acquired during the course.

Evaluation	**Marks**	**Approach**	**Marks**
Internal evaluation (Theory)	40 Marks	Assignment/Tutorial	8
		Attendance	4
		Quizzes	4
		Presentation/Class Performance	4
		Unit Tests/ Internal Assessments	20
Semester End Examination	60 Marks		60
	Total		**100**

Marks Distribution for End Semester Examination

Chapters/Units	**Hours Allocated**	**Marks Distribution (Tentative)***
Unit I	4	5
Unit II	7	9
Unit III	2	2
Unit IV	8	12
Unit V	4	5
Unit VI	6	8
Unit VII	5	7
Unit VIII	4	5
Unit IX	5	7
Total	**45**	60

* There may be minor deviation in marks distribution.

Far Western University
Faculty of Engineering

Course Title:	Computer Programming	Course Code:	CT1105
Course Credit:	3 (3-1-2)	Year/Semester:	I/I
Level:	Undergraduate	Program:	Civil Engineering

Course Description

This course introduces civil engineering students to the fundamental concepts of computer programming. The primary goal is to demystify programming, explaining how computers execute instructions and how programs are structured. The course focuses mainly on procedural programming paradigms, utilizing the C programming language. Towards the latter part of the course, students will be introduced to the basic principles of Object-Oriented Programming (OOP) using C++, providing an understanding of classes, objects, and simple object-oriented design. Through hands-on exercises and problem-solving, students will develop logical thinking, algorithmic design skills, and the ability to write, debug, and execute simple programs relevant to engineering applications.

General Objectives

- Provide the basic definitions and concepts of computer programming, including algorithms, data representation, and program execution flow .
- Develop the ability to understand and apply the principles of procedural programming using the C language, including sequence, selection and iteration control structures.
- Develop the ability to effectively use variables, data types, operators, arrays, strings, and functions to write C programs.
- Develop skill to design and implement modular programs using functions.
- Analyze simple computational problems, develop algorithms, and translate them into working C programs.
- Provide the understading of the basic concepts of Object-Oriented Programming (OOP), including classes, objects, and their advantages, through introductory examples in C++.
- Develop the ability to recognize the importance and applicability of computer programming as a problem-solving tool in various civil engineering disciplines

Learning Outcome

After completing this course, students will be able to:

LO1: Explain and apply fundamental programming concepts: Articulate basic principles of computer programming and develop algorithms using sequential, conditional, and iterative control structures in the C language.

LO2: Implement C programs using core features: Write, compile, and execute C programs utilizing variables, data types, operators, arrays, functions, and basic file operations to solve given problems.

LO3: Debug and test programs effectively: Identify and correct syntax and logical errors in C programs, ensuring they perform as intended.

LO4: Apply introductory Object-Oriented Programming (OOP) concepts: Understand and implement basic OOP principles, including defining and using simple classes and objects, using C++.

LO5: Solve simple engineering problems computationally: Formulate and develop computational solutions for basic engineering problems by applying the learned programming techniques.

Content

Learning Objectives	**Content**	**Hrs.**
LO 1	**Unit 1: Introduction to Programming** 1.1 Computer Software and their classification 1.2 Program, Programming, Programming languages 1.3 Time-line of programming languages 1.4 Problem Analysis, Algorithm, Flowchart 1.5 Program execution, compilation, debugging, testing 1.6 Language processors: Interpreters, Compilers, Linkers, Loaders	5
LO 2	**Unit 2: Fundamentals of C programming** 2.1 Structure of a C Program 2.2 Character set, Keywords, and Identifiers 2.3 Datatypes in C, variables, declaration 2.4 Constants 2.5 Operators in C 2.6 Statements and Expressions 2.7 Type Conversion and Type Casting	6

LO 2	**Unit 3: Writing a program in C** 3.1 Input/output Statements 3.2 Formatted input/output 3.3 Unformatted input/output 3.4 Preprocessor Directives	4
LO 2, LO 3	**Unit 4: Control Structure** 4.1 Condition statements a. if statement b. if-else statement c. Nested if-else statement d. switch statement 4.2 Loop Statements a. for loop b. while loop c. do-while loop d. Nested loops 4.3 Break Control Statements a. Break b. Continue c. go-to statement	6
LO 2, LO 4, LO 5	**Unit 5: Functions** 5.1 Introduction 5.2 Types of function 5.3 Function Prototypes 5.4 Function definition and return statement 5.5 Function invocation 5.6 Passing Parameters to the function 5.7 Recursive Functions	6
LO 2, LO 3, LO 5	**Unit 6: Arrays and Strings** 6.1 Defining an Array 6.2 Accessing Array Elements 6.3 One-dimensional Arrays 6.4 Multi-dimensional Arrays 6.5 Strings and string manipulation	4
LO 2, LO 3, LO 5	**Unit 7: Pointers** 7.1 Introduction 7.2 Pointer declaration 7.3 Pointer arithmetic 7.4 Pointer and Array 7.5 Pointers and Strings 7.6 Dynamic Memory Allocation	4
LO 3, LO 5	**Unit 8: Structure and Data Files**	4

	8.1 Introduction to Structure 8.2 Structure declaration and initialization 8.3 Introduction to data files 8.4 Defining opening and closing a file 8.5 Input/Output operations on Files	
LO 4	**Unit 9: Object Oriented Programming Concept in C++** 9.1 Procedure-oriented vs object-oriented programming 9.2 C++ Features 9.3 Class, Objects and accessing data members and member functions 9.4 Input/output streams, access specifiers 9.5 Concepts of object-oriented programming (abstraction, encapsulation, inheritance and polymorphism)	6

Reference books

1. Reema Thareja, "*Introduction to C Programming"*, Oxford University Press
2. Brian W. Keringhan & Dennis M. Ritchie, "*The 'C' Programming Language*", PHI
3. Bryons S. Gotterfried, "*Programming with C*", TMH
4. Yashavant Kanetkar, "*Let Us C*", BPB
5. Lafore, R. *Object Oriented Programming in C++*. USA: SAMS Publication.

Method of Instruction

Lecture, Lab and Tutorial

Laboratory Works

The laboratory component reinforces theoretical learning through hands-on experience. Students will learn to:

- Translate algorithms into working programs.
- Test, debug, and improve code systematically.
- Develop structured and well-documented programs.
- Collaborate on programming tasks and manage small-scale projects.

Generic Laboratory Topics

- Introduction to the C Environment: Writing, compiling, and executing simple programs.
- Data Types and Expressions: Programs using variables, constants, operators, and type casting.

- Control Structures: Programs using decision-making and looping constructs.
- Functions and Recursion: Implementing user-defined functions and recursive algorithms.
- Arrays: One- and two-dimensional array manipulation, searching, and sorting algorithms.
- Strings: String handling and manipulation using and with library functions.
- Pointers: Using pointers with variables and arrays.
- Structures and Unions: Programs using structured data types for data organization.
- File Handling: Reading, writing, and updating data in files.
- Simple program to define class, object and accessing their members.

Evaluation Approach

The evaluation of student performance shall be conducted in two distinct phases: Internal (Continuous) Assessment and Semester-End Examination. Student must pass the internal evaluation to qualify for the semester-end examination. The Internal Evaluation will be carried out as a continuous assessment (CA) process throughout the semester. It will include a range of formative assessment components designed to measure both theoretical understanding and practical competence. The evaluation modalities may comprise unit tests, take-home assignments, class tests, quizzes, mini projects, presentations, and viva-voce examinations, as deemed appropriate by the instructor. The Semester-End Examination shall be a comprehensive written examination, aimed at evaluating the students' overall conceptual understanding, analytical ability, and problem-solving skills acquired during the course.

Evaluation	**Marks**	**Approach**	**Marks**
Internal evaluation (Theory)	40 Marks	Assignment/Tutorial	8
		Attendance	4
		Quizzes	4
		Presentation/Class Performance	4
		Unit Tests/ Internal Assessments	20
Practical Examination	20 Marks (Internal)	Practical Report	16
		Attendance	4
	30 Marks (External)	Practical Exam	20
		Viva	10
Semester End Examination	60 Marks		60
	Total		**150**

Marks Distribution for End Semester Examination

Chapters/Units	Hours Allocated	Marks Distribution (Tentative)*
Unit I	5	6
Unit II	6	8
Unit III	4	5.5
Unit IV	6	8
Unit V	6	8
Unit VI	4	5.5
Unit VII	4	5.5
Unit VIII	4	5.5
Unit IX	6	8
Total	**45**	60

* There may be minor deviation in marks distribution.

Far Western University
Faculty of Engineering
Mahendranagar, Kanchanpur, Nepal

Course Title:	Engineering Drawing	Course Code:	AR1106
Course Credit:	2 (1-0-4)	Year/Semester:	I/I
Level:	Undergraduate	Program:	Civil Engineering

Course Description

This course provides a comprehensive introduction to engineering drawing, covering instrumental techniques, freehand lettering, dimensioning, and the use of scales for accurate graphical communication. It develops students' ability to construct geometric shapes, curves, solids, and solve spatial problems through descriptive geometry and multiview projection. The course further trains students to interpret and produce orthographic drawings, sectional views, and developments of complex surfaces used in engineering practice.

General Objectives

The general objectives of this course are:

- to provide foundational knowledge on essential engineering drawing instruments, conventions, lettering forms, dimensioning symbols, and basic geometric elements used in technical graphics.
- to develop familiarity with key instrumental and freehand drawing techniques, including dimensioning, scaling, and geometric constructions
- To develop students' capacity to integrate various drawing tools and techniques in order to visualize, analyze, and represent objects coherently through descriptive geometry and orthographic projection, linking two-dimensional and three-dimensional representation.
- To foster the ability to interpret and produce complete engineering drawings—including sectional views, developments, and intersections of solids—in a manner that supports advanced problem-solving and professional communication consistent with engineering standards.

Learning Outcome

After completing this course, students will be able to:

LO1: Identify and apply standard engineering drawing instruments, conventions, lettering styles, dimensioning methods, and scaling techniques for basic technical communication.

LO2: Use and demonstrate proficiency in instrumental drawing, freehand lettering, dimensioning, and geometric constructions to produce accurate engineering sketches and diagrams.

LO3: Visualize, analyze, and construct two-dimensional and three-dimensional representations of objects using descriptive geometry and orthographic projection techniques.

LO4: Interpret, generate, and evaluate advanced engineering drawings—including sectional views, developments, and intersections of surfaces and solids—to solve engineering graphical problems in new or complex contexts.

LO5: Draw and interpret three-dimensional objects using appropriate pictorial projection methods, including axonometric, oblique, and perspective projections, in engineering drawing**.**

Content

Learning Objectives	**Content**	**Hrs.**
LO1	**Unit I: Instrumental Drawing; Practices and Techniques** 1.1 Equipment and Materials; Description of drawing instruments, auxiliary equipment and drawing materials 1.2 Techniques of Instrumental Drawing, Pencil sharpening, securing paper, proper use of T- squares, triangles, scales, dividers, and compasses, erasing shields, French curves, inking pens.	2
LO1&LO2	**Unit II: Freehand Technical lettering** 2.1 Lettering strokes, letter proportions, use of pencils and pens, uniformity and appearance of letters, freehand techniques, inclined and vertical letters and numerals, upper and lower cases, Standard English lettering forms	2
LO1&LO2	**Unit III: Dimensioning** 3.1 Fundamentals and techniques; Size and location dimensioning ; measurement units; SI conventions 3.2 General dimensioning practices; placement of dimensions; aligned and unidirectional	2
LO1 & LO2	**Unit IV: Engineering Scale:** 4.1 Use of scales, , reducing and enlarging drawings 4.2 Representative Factor, 4.3 Construction and Types of Scales, Plain Scales, Diagonal Scales, Vernier Scales, Comparative Scales 4.4 Scale of Chords	2
LO1&LO2	**Unit V Applied Geometry** 5.1 Plane Geometrical construction; Bisecting and trisecting lines and angles, proportional division of lines, construction of angles, triangles, squares, and polygons. Construction using	6

	tangents and circular arcs 5.2 Methods of drawing standard curves such as ellipses, parabolas, hyperbolas, involutes, spirals, cycloid, helices (cylindrical and conical). 5.3 Solid Geometrical Construction; Classification and pictorial representation of solid regular objects such as; **Prisms:** square, cubical, triangular and oblique **Cylinders:** right and oblique; Cones: right and oblique, **Pyramid :** square, triangular, oblique, truncated, Doubly-Curved and, **Warped Surfaces:** Sphere, Torus, oblate ellipsoid, serpentine, paraboloid, hyperboloid	
LO1, LO2 & LO3	**Unit VI Basic Descriptive Geometry** 6.1 Introduction: Application of descriptive geometry, principles to the solution of problems involving positioning of objects in three-dimensional space 6.2 The projection of points, lines, planes and solid in space 6.3 Projection of Solids Placed in different positions, 6.4 Parallel Lines 6.5 True Length of Lines; horizontal , inclined and oblique lines 6.6 Perpendicular Lines 6.7 Bearing of a Line 6.8 Point view or End View of a Line 6.9 Shortest Distance from a point to a Line 6.10 Principal Lines of a plane 6.11 Edge View of a plane 6.12 True shape of an Oblique plane 6.13 Intersection of a Line and a plane 6.14 Angle Between a Line and a plane 6.15 Angle Between Two Intersecting Lines 6.16 Angle Between Two Non- Intersecting (Skew) lines 6.17 Angle between two planes 6.18 Shortest Distance Between Two Skew Lines	10
LO1, LO2 & LO3	**Unit VII Theory of Projection and Multi view (Orthographic) Projection Drawing** 7.1 Common types of projections – Pictorial (Perspective, Isometric, Oblique) and Orthographic Projection 7.2 System of orthographic projection: First angle projection and Third angle projection 7.3 Principal Views; Methods for obtaining orthographic views ;Projection of lines, angles and plane surfaces; analysis in three views 7.4 Projection of curved lines and surfaces, object orientation and selection of views for best representation; full and hidden lines 7.5 Orthographic Drawings; making an orthographic drawing, visualizing objects from the given views 7.6 Interpretation of adjacent areas, true-length lines,	12

	representation of holes, conventional practices	
LO1, LO2, LO3 & LO4	**Unit VIII Sectional Views** 8.1 Full Section 8.2 Half Section 8.3 Broken Section 8.4 Revolved Section 8.5 Removed (Detail) Section 8.6 Phantom or Hidden Section 8.7 Auxiliary Sectional views 8.8 Specifying Cutting Planes for Section 8.9 Conventions for hidden lines, holes	4
LO1,LO2,LO3 & LO4	**Unit IX Developments and Intersections** 9.1 Introduction and Projection of Solids 9.2 Developments: General Concepts and Practical Consideration; Developments of a right or oblique prism, cylinder, pyramid and cone ; Development of a truncated pyramid and cone; Triangulation method for approximately developed surfaces; Transition pieces for connecting different shapes; Development of a sphere 9.3 Intersections & Interpretation : (i) Lines of intersection of geometric surfaces (ii) Piercing point of a line and a geometric solid (iii)Intersection lines of two planes (iv) Intersection of prisms and pyramids (v) Intersection of a cylinder and an oblique plane (vi) Intersection of a sphere and an oblique plane (vii)Constructing a development using auxiliary views (viii) Intersection of two cylinders (ix) Intersection of a cylinder and a cone	12
LO5	**Unit X: Pictorial Projection** 10.1 Introduction; Characteristics, advantages and disadvantages 10.2 Axonometric Projection; Isometric drawing, Dimetric and Trimetric drawing 10.3 Oblique Projection; Cabinet and Cavalier drawing 10.4 Perspective Projection; Parallel and Angular drawing	8

LABORATORY (60 hours for a group of maximum 24 students)

1. Freehand technical lettering and use of drawing instruments
2. Freehand technical lettering and use of drawing instruments (cont)
3. Dimensioning and Scaling
4. Applied geometrical drawing I
5. Applied geometrical drawing II
6. Descriptive geometry I

7. Descriptive geometry II
8. Descriptive geometry III
9. Projection and Multi view Drawing I
10. Projection and Multi view Drawing II
11. Sectional Views I
12. Sectional Views II
13. Developments of Surface I
14. Developments of Surface II
15. Effect of Intersections
16. Pictorial Projection

Recommended Books:

- Bhatt N.D. (2011) *Elementary Engineering drawing*, Charotar Publishing House.
- Dhawan,R.K. (2006). *A Text book of Engineering Drawing*. S. Chand and Company Limited , India.
- French T E., Vierck C.J. and Foster R.J (1981). *Engineering Drawing and Graphic Technology*, McGraw Hill.
- Luintel, M. C. *Engineering Drawing (Vol I)*, Athrai Publication (P) Limited.
- Luzadder W.J. (1981). *Fundamentals of Engineering Drawing*, Prentice Hall.

Method of Instruction

Lecture and Practical

Evaluation Approach

The evaluation of student performance shall be conducted in two distinct phases: Internal (Continuous) Assessment and Semester-End Examination. Student must pass the internal evaluation to qualify for the semester-end examination.

The Internal Evaluation will be carried out as a continuous assessment (CA) process throughout the semester. It will include a range of formative assessment components designed to measure both theoretical understanding and practical competence. The evaluation modalities may comprise unit tests, take-home assignments, class tests, quizzes, and viva-voce examinations, as deemed appropriate by the instructor.

The Semester-End Examination shall be a comprehensive written examination, aimed at evaluating the students' overall conceptual understanding, analytical ability, and problem-solving skills acquired during the course.

Evaluation	**Marks**	**Approach**	**Marks**
Internal evaluation	40 Marks	Assignment	6
		Attendance and Class Performance	4
		Unit Tests/ Internal	10

		Assessments	
		Drawing Sheet Evaluation	20
		Total Internal	**40**
Semester End Examination	60 Marks		**60**
	Total		**100**

Marks Distribution for End Semester Examination

Chapters/Units	**Hours Allocated**	**Marks Distribution (Tentative)***
Unit I to IV	8	6
Unit V	6	6
Unit VI	10	10
Unit VII	12	12
Unit VIII	4	5
Unit IX	12	13
Unit X	8	8

* There may be minor deviation in marks distribution.