**Pokhara University**
**Faculty of Science and Technology**

Course Code: CHM 110
Course Title: Applied Chemistry (2-1-2)
Nature of the Course: Theory and Practical
Level: Bachelor

Full Marks: 100
Pass Marks: 45
Total Lectures: 30 hours
Program: BE

## 1. Course Description

This Applied Chemistry course is designed to help the engineering students to use different materials without causing any wastage or pollution thus helping the engineers in handling a wide range of materials in the right way.

## 2. General Objectives

The general objectives of the course are:

- To focus on the general application of chemical principles to analyse and evaluation of engineering problems such as by developing engineering materials
- To make students aware about the proper and safe handling of engineering materials to protect oneself and to the environment.

## 3. Methods of Instruction

Lecture, Tutorial, Discussion, Readings and Practical works

## 4. Syllabus in Detail

| Specific Objectives | Contents |
|---|---|
| • Define the application of electrochemistry in battery-production and various types of batteries<br>• Explain corrosion and its control measures | **Unit I: Electrochemistry and Battery Technology (6 hrs)**<br>1.1 Electrolytic cell and its application<br>1.2 Introduction to Galvanic cell and examples, electrode potential, EMF of the cell and cell representation.<br>1.3 Electrochemical series & its application<br>1.4 Electrochemical theory of corrosion and its preventions.<br>1.5 Batteries and their importance, Classification of batteries- primary, secondary and reserve batteries with examples.<br>1.6 Construction, working and applications of: Zn-Cu, Ni-Cd, Lithium-ion and Sodium ion battery. |
| • Identify different types of environmental pollutants, their causes, health impacts and control measures<br>• Explain safe handling, use and disposal of engineering materials | **Unit II: Environmental Chemistry (5 hrs)**<br>2.1 Air, Water and Soil Pollution: causes, effects and control measures<br>2.2 Water Quality Analysis<br>2.2.1 Alkalinity<br>2.2.2 Hardness<br>2.2.3 Free Chlorine |

| | |
|---|---|
| | 2.2.4 Dissolved Oxygen<br>2.2.5 Chemical Oxygen Demand |
| • Define the characteristics of transition metals which thus can be applied in designing engineering devices and products | **Unit III: Transition Elements and its Applications (4 hrs)**<br>3.1 Introduction to transition elements and its position in the periodic table<br>3.2 Characteristics of transition elements:<br>3.2.1 Electronic Configuration<br>3.2.2 Atomic radii<br>3.2.3 Variable oxidation states<br>3.2.4 Complex formation<br>3.2.5 Colour and Magnetic Properties<br>3.2.6 Catalytic property<br>3.3 Applications of Transition metals in various engineering fields |
| • Illustrate types of organic reactions, possible reaction path and its governing factors | **Unit IV: Types of Organic Reactions (4 hrs)**<br>4.1 Substitution reaction:<br>SN1 and SN2 reactions, mechanism, kinetics, stereochemistry, reactivity, factors affecting this type of reaction.<br>4.2 Elimination reaction:<br>E1 and E2 reactions, mechanism, kinetics, orientation (Saytzeff's rule), reactivity, factors affecting this type of reaction. |
| • Analyse the properties of various engineering materials<br>• Recognize the rapidly evolving field of material chemistry and its application in the industry | **Unit V: Engineering Materials and its Applications (7 hrs)**<br>5.1 Explosives: Introduction, preparation, properties and applications of TNT and TNG<br>5.2 Cement: Types, manufacture of Portland cement setting and hardening mechanism of cement<br>5.3 Paints: Introduction, properties and constituents<br>5.4 Sensors -Introduction, basic principle and applications<br>5.5 Photovoltaic cells-Introduction, basic principle and applications |
| • Illustrate polymers as substitute materials and define their applications to various engineering fields | **Unit VI: Polymers and its Applications (4 hrs)**<br>6.1 Polymers<br>6.1.1 Addition, condensation and copolymerization<br>6.1.2 Preparation, properties and uses of PVC, Teflon, Silicone Rubber and Neoprene<br>6.2 Concept of conducting, & non-conducting, biodegradable & non-biodegradable polymers, examples and their applications |

## 5. List of Tutorials

The following tutorial activities of 15 hours per group of maximum 24 students should be conducted to cover all the required contents of this course:

| S.N. | Tutorials |
|---|---|
| 1 | Problems related to calculation of EMF of cell using Nernst equation. |
| 2 | Pollution issues due to air, water and soil pollutants with reference to urban areas |
| 3 | Problems related to SN1, SN2, E1 and E2 organic reactions |
| 4 | Problems related to engineering materials (manufacture and setting of cement , use and preparation of explosive, use of paints, sensor and photovoltaic cell) |
| 5 | Problems related to color, formation of complexes and magnetic properties of transition elements. |

## 6. Practical Works (30 hours for a group of maximum 24 students)

| S.N. | Practical Works |
|---|---|
| 1 | To determine total alkalinity of the given water sample (Two samples)-Acid-Base titration method |
| 2 | To determine the total hardness of water sample-Complexometric Titration method |
| 3 | To determine the amount of free chlorine in the given water sample- Titration method |
| 4 | To estimate DO (dissolved oxygen) in the given water sample-Winkler's method |
| 5 | To construct Zn-Cu galvanic cell and to measure EMF of the cell |
| 6 | To analyse E. Coli and total coliform bacteria in the water sample- Membrane filtration |
| 7 | Physico- chemical analysis of water samples (pH, conductivity, turbidity, total dissolved solid and suspended solid) |
| 8 | To determine pH of unknown buffer by preparing standard known buffer (Acidic and basic buffer) |

## 7. Evaluation System and Students' Responsibilities

**Evaluation System**

In addition to the formal exam(s), the internal evaluation of a student may consist of quizzes, assignments, lab reports, projects, class participation, etc. The tabular presentation of the internal evaluation is as follows.

| Internal Evaluation | Weight | Marks | External Evaluation | Marks |
|---|---|---|---|---|
| **Theory** | | 30 | Semester-End examination | 50 |
| Attendance & Class Participation | 10% | | | |
| Assignments | 20% | | | |
| Presentations/Quizzes | 10% | | | |
| Internal Assessment | 60% | | | |
| **Practical** | | 20 | | |
| Attendance & Class Participation | 10% | | | |
| Lab Report/Project Report | 20% | | | |
| Practical Exam/Project Work | 40% | | | |
| Viva | 30% | | | |
| Total Internal | | 50 | | |
| Full Marks: 50 + 50 = 100 | | | | |

**Student's Responsibilities**

Each student must secure at least 45% marks separately in internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

## 8. Prescribed Books and References

**Text Books**


1. Maron, S. H. & Prutton, C. (2017). *Principle of Physical Chemistry*, Oxford & IBH Pub. Co.
2. Lee, J. D. (2008). *Concise inorganic chemistry*, John Wiley & Sons.
3. Morrison, R. T., & Boyd, R. N. (2012). Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd.


**References**


1. Madan, R. D. & Prakash, S(1999). *Modern Inorganic Chemistry*, S. Chand publishing.
2. Bahl, B. S., & Bahl, A. (2017). *A textbook of organic chemistry*, S. Chand Publishing.
3. Jain and Jain (2013). *A Text Book of Engineering Chemistry,* Dhanpat Rai Publications.

**Pokhara University**
**Faculty of Science and Technology**

Course Code: PHY 110
Course title: Applied Physics (3-2-2)
Nature of the Course: Theory & Practical
Level: Bachelor

Full Marks: 100
Pass Marks: 45
Total Lectures: 45 hours
Program: BE

## 1. Course Description

This course covers the fundamental topics of physics and basic principles that are required to study other engineering courses. It develops the ability to identify, formulate and solve engineering physics problems. Moreover, it enables to formulate, conduct, analyze and interpret experiments in engineering physics through tutorials, laboratory work and self-learning activities.

## 2. General Objectives

The general objectives of this course are:

- To equip the students with the fundamental concept and laws of oscillation, electromagnetism and thermodynamics.
- To acquaint the students with waves, laser, optical fiber, quantum mechanics and enlighten the importance of capacitor and dielectrics.

## 3. Methods of Instruction

Lecture, Tutorial, Discussion, Readings and Practical works

## 4. Contents in Detail

| Specific Objectives | Contents |
|---|---|
| Understand mechanical oscillations, solve problems related to different types of oscillation, familiar with the scope in various engineering fields. | **Unit I: Mechanical Oscillation (6 hrs)**<br>1.1 Free oscillation, Damped oscillation and Forced oscillation (Physical meaning and equations).<br>1.2 Compound pendulum, Minimum and maximum time period in compound pendulum, Interchangeability of point of suspension and point of oscillation in compound pendulum, Torsion pendulum, Determination of modulus of rigidity of material using torsion pendulum. |
| Solve and analyze the problems related to waves | **Unit II: Wave Motion (4 hrs)**<br>Introduction of wave, wave velocity and particle velocity, types of waves and their applications, Speed of wave in stretched string, energy, power and intensity of plane progressive wave, standing wave and resonance, sonometer. |
| Solve the problems related to reverberation in different units of building. Solve the problems | **Unit III: Acoustics (4 hrs.)**<br>3.1 Classification of sound waves, Acoustics of building, Reverberation of sound, absorption coefficient, Noise |

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| related to ultra sound. | pollution and its control, Sound insulation, Sabine equation.<br>3.2 Introduction, production and applications of ultrasonic wave. Ultrasonic method in non-destructive testing. |
| understand the use of lasers in engineering sciences and solve problems related to laser and fiber optics. Apply the concept of optical fibers in communication system and sensors. | **Unit IV: Photonics (6 hrs.)**<br>4.1 Laser: Introduction of laser, Principles of generation of laser light (induced absorption, spontaneous emission, stimulated emission, population inversion, pumping, metastable state), He–Ne laser, Semiconductor laser, Applications of laser.<br>4.2 Fiber optics: Introduction, Types of optical fiber, Principle of propagation of light wave through optical fiber (Acceptance angle), Numerical aperture, Applications of optical fiber in communications, Optical fiber sensors. |
| Evaluate the capacity of capacitors to store energy with and without dielectrics.<br>Solve problems related to electrostatics. | **Unit V: Capacitor and Dielectric (6 hrs.)**<br>5.1 Capacitor: Introduction, Types of capacitors, Charging and discharging of capacitor.<br>5.2 Dielectric: Introduction, Dielectric constant, electric flux density, Polarization, Polarization in free space, Gauss law in dielectric, Electronic and Ionic polarization (Clausius-Mossotti equation). |
| Deal with interaction between electric field and magnetic field on matter.<br>Analyze the relationship between electric field, magnetic field and speed of wave. | **Unit VI: Electromagnetism (6 hrs.)**<br>6.1 EM Oscillation: LC oscillation, Damped LCR oscillation, Forced electromagnetic oscillation, resonance and quality factor<br>6.2 EM waves: Maxwell equations in integral form, Conversion of Maxwell's equations in differential form, Continuity equation, Relation between electric field, magnetic field and speed of light, wave equations in free space, verification of light wave as an electromagnetic wave, Wave equation in dielectric medium |
| Apply principles of quantum mechanics to investigate the observables on known wave functions. Solve the problems related to particle wave using Schrodinger's wave equations. | **Unit VII: Quantum Mechanics (5 hrs.)**<br>Inadequacy of classical mechanics, Importance of quantum mechanics, Matter wave (de-Broglie equation), Wave function and its significance, Energy and momentum operator, Time independent and time dependent Schrodinger wave equations, Application of Schrodinger wave equation for the electron in metal, Normalized wave function describing the motion of an electron inside in an infinite potential well. |
| Acquainted with the laws of thermodynamics and applications.<br>Solve the problems related to | **Unit VIII: Fundamentals of Thermodynamics and Heat Transfer (8 hrs.)**<br>8.1 Concepts and definition: applications of |

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|---|---|
| thermodynamics and heat transfer. | thermodynamics, properties and state of substance, thermodynamics properties and types, processes (definition, characteristics and examples): reversible and irreversible process.<br>8.2 Laws of thermodynamics: first law of thermodynamics, first law for closed system, internal and stored energy, joules law, enthalpy, specific heat, application of first law for closed system, Related problems on closed system, second law of thermodynamics, heat engine (four components of refrigerator and heat pump, COP of refrigerator and heat pumps), Kelvin-Planck and Clausius statement of second law.<br>8.3 Heat transfer: modes of heat transfer (conduction, convection and radiation), statement and assumption of Fourier's law of thermal conductivity, one dimensional steady state heat conduction through plane wall, basic laws of radiation (Emissive power and emissivity, Stefan-Boltzmann's law), Concept of black bodies. |

*Note:* The figures in the parentheses indicate the approximate periods for the respective units.

## 5. List of Tutorials

The following tutorial activities of 15 hours per group of maximum 24 students should be conducted to cover all the required contents of this course.

| S.N. | Tutorials |
|---|---|
| 1 | Solving the problems related to different oscillation. |
| 2 | Solving and analyzing the problems related to waves. |
| 3 | Determination of standard reverberation time for normal human ear and solving problems related to ultra sound. |
| 4 | Determination of angle of acceptance for working of optical fiber and finding population of atoms in different energy states. |
| 5 | Solving the problems for different combination of capacitors and finding the charging and discharging time constant for capacitor. |
| 6 | Solving the problems related to Gauss law of electrostatics. |
| 7 | Determination of frequency of damped and undammed LC oscillation and analyzing the relationship between electric field, magnetic field and speed of wave. |
| 9 | Solving the problems related to thermodynamics and heat transfer. |

## 6. Practical Works (Any Eight)

| S.N. | Practical works |
|---|---|
| 1 | To determine the acceleration due to gravity and radius of gyration of bar pendulum. |
| 2 | To determine the value of modulus of rigidity of the material given and moment of inertia of circular disc using torsion pendulum. |
| 3 | To determine the acceptance angle of an optical fiber using laser source. |

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| 4 | To determine the frequency of AC mains by using sonometer apparatus. |
| 5 | To determine the wavelength of laser light by using diffraction grating |
| 6 | To determine the capacitance of given capacitor by charging and discharging through resistor. |
| 7 | To plot a graph between current and frequency in an LRC series circuit and to find: i) the resonance frequency ii) the quality factor. |
| 9 | To determine the dielectric constant of a given material |
| 10 | To determine the Planck's constant and photoelectric work functions of the material. |
| 11 | To measure the pressure, specific volume and temperature. |
| 12 | To find out the efficiency of a compressor. |
| 13 | To measure the rate of heat, transfer by conduction |
| 14 | To measure the performance of a Refrigeration/ Heat pump |

## 7. Evaluation system and Students' Responsibilities

### Evaluation System

In addition to the formal exam(s), the internal evaluation of a student may consist of quizzes, assignments, lab reports, projects, class participation, etc. The tabular presentation of the internal evaluation is as follows.

| **Internal Evaluation** | **Weight** | **Marks** | **External Evaluation** | **Marks** |
|---|---|---|---|---|
| **Theory** | | 30 | Semester-End examination | 50 |
| Attendance & Class Participation | 10% | | | |
| Assignments | 20% | | | |
| Presentations/Quizzes | 10% | | | |
| Internal Assessment | 60% | | | |
| **Practical** | | 20 | | |
| Attendance & Class Participation | 10% | | | |
| Lab Report/Project Report | 20% | | | |
| Practical Exam/Project Work | 40% | | | |
| Viva | 30% | | | |
| Total Internal | | 50 | | |
| Full Marks: 50 + 50 = 100 | | | | |

### Student's Responsibilities

Each student must secure at least 45% marks separately in internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

## 8. Prescribed Books and References

### Text Books

1. Halliday, D., Resnick, R., & Walker, J. (2013). *Fundamental of Physics*. John Wiley and Sons. Inc.

2. Howel, J. R. & Buckius, R. O. (1992). *Fundamentals of Engineering Thermodynamics*. McGraw-Hill Publishers
3. Young, H. D. & Freedman. R. A. (2009). *Sears and Zemansky's University Physics*. Pearson Education.

**References**

1. Arora, C. L. (2020). *B. Sc. Practical Physics*, S. Chand Publishing.
2. David, J. Griffiths (2008). Introduction to Electrodynamics, Prentice Hall of India Private Limited, New Delhi.
3. Malik, H. K., Singh, A. K. (2010). *Engineering Physics*, Tata McGraw Hill Education Private Ltd.
4. Mathur, D.S. (2003). *Mechanics*, S. Chand and Company Ltd.
5. Murugeshan, R. & Sivaprasath, K. (2009). Modern Physics, S. Chand and Company Ltd.
6. Reitz, J., Milford, F.J. & Christy, R.W (19986). *Foundations of Electromagnetic Theory.*, Pearson Education.
7. Subrahmanyam, N., Lal, B. (2005). *A text book of Optics*, S. Chand and Company Ltd.
8. Tiwari, K. K (2001). *Electricity and Magnetism*, S. Chand and Company Ltd.
9. Van Wylen, G. J. and Sonntag, R. E. (1989). *Fundamentals of Classical Thermodynamics*, Wiley Eastern Limited, New Delhi.

**Pokhara University**
**Faculty of Science and Technology**

Course No.: MTH 110
Course title: Calculus I (3-2-0)
Nature of the course: Theory
Level: Bachelor

Full marks: 100
Pass marks: 45
Total lectures: 45 Hrs
Program: BE

## 1. Course Description

This course is designed for developing competency of the students on the fundamental concepts, principals and applications of differential and integral calculus for solving engineering problems. It is equipped with differential calculus, integral calculus and ordinary differential equations. The review part of the content is based on previous learning in the school level. The course will be delivered through lecture method, assignment on practically base engineering problems and class tests.

## 2. General Objectives

The course is designed with the following general objectives:

- To acquaint the students with applications of differential and integral calculus in engineering.
- To expose the students with the application of differential equations for modeling engineering problems.

## 3. Methods of Instruction

Lecture, tutorials, discussions and assignments

## 4. Contents in Detail

| Specific objectives | Contents |
|---|---|
| • Explain the importance of limit and continuity in differential problems and use Leibnitz theorem to evaluate higher derivatives. | **Unit I: Limit Continuity and Derivatives (5 hrs)**<br>1.1 Introduction<br>1.2 Limit, continuity and differentiability<br>1.3 Higher order derivatives by Leibnitz method. |
| • Apply derivatives in mean value theorem, series expansion, asymptotes and trace curve for the given function. | **Unit II: Applications of Derivatives (8 hrs)**<br>2.1 Mean value theorems: Rolle's theorem, Lagrange's Theorem (Geometrical interpretation and verification) and applications<br>2.2 Higher order mean value theorem: Taylor's Series, Maclaurin's Series expansion of function.<br>2.3 Asymptotes to Cartesian curves up to four degrees.<br>2.4 Curve tracing in Cartesian form and parametric form<br>2.5 Curvature |
| • Evaluate Proper and improper integrals. | **Unit III: Integral Calculus (6 hrs)**<br>3.1 Introduction<br>3.2 Review on Indefinite Integral and fundamental theorem of integral calculus. |

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|---|---|
| | 3.3 Definite integral and its properties<br>3.4 Improper Integrals; comparison test.<br>3.5 Reduction formula, Beta Gamma functions |
| • Evaluate arc length, area, and volume through integration. | **Unit IV: Application of Integral (6 hrs)**<br>4.1 Application of integrals for finding area beneath a curve and between two curves and arc length<br>4.2 Surface and volume of solid of revolution in the plane for Cartesian and parametric curves. |
| • Compute partial derivatives with the concept of total differentials. | **Unit V: Partial Differentiation (3 hrs)**<br>5.1 Introduction<br>5.2 Partial Derivatives<br>5.3 Homogeneous function and Euler's theorem for the function of two and three variables<br>5.4 Total Derivatives and Differentiation of Implicit functions. |
| • Define extreme value and compute its value for two and three variables through partial derivatives. | **Unit VI: Application of Partial Differentiation (4 hrs)**<br>6.1 Extrema of functions of two and three variables.<br>6.2 Lagrange's method of undetermined Multipliers (up to 2 multipliers) |
| • Solve first order differential equations. | **Unit VII: First Order Ordinary Differential Equations (6 hrs)**<br>7.1 Review of separable, homogeneous and exact differential equation with engineering applications<br>7.2 Linear, Bernoulli equation and Riccati's equation with engineering application.<br>7.3 Mathematical modeling of engineering problems using first order equation. |
| • Solve second order differential equations in relation to engineering problems. | **Unit VIII: Second Order Ordinary Differential Equations (7 hrs)**<br>8.1 Second order Homogeneous ODE with constant and variable coefficients, Euler-Cauchy equation.<br>8.2 Existence and uniqueness of solutions, Wronskian and general solutions for solving ODE.<br>8.3 Non-homogeneous second order ODE and Solution by undetermined coefficients and variation of parameters and engineering application |

*Note:* The figures in the parentheses indicate the approximate periods for the respective units.

## 5. List of Tutorials

Tutorial work covers the work to be done in tutorial. This will enable the students to compute the mathematics problem under the supervision of the course leader. The major tutorial works are as follows:

Total: 30 Hours

| Unit no. | Unit name | List of Tutorials | Tutorial hours |
|---|---|---|---|
| 1 | **Limit Continuity and Derivatives** | 1.1 Problems on Limit and continuity.<br>1.2 Show that differentiability implies continuity but the converse may not be true<br>1.3 Evaluation of higher order derivatives by Leibnitz method | 1 hr<br>1 hr<br>1 hr |
| 2 | **Applications of Derivatives** | 2.1 Problems in Mean value theorems: Rolle's theorem, Lagrange's Theorem<br>2.2 Expand the functions through Taylor's Series, and Maclaurin's Series<br>2.3 Evaluation of Asymptotes to Cartesian curves.<br>2.4 Trace Curve for the equations in Cartesian form and parametric form<br>2.6 Problems in Curvature | 1 hr<br>2 hrs<br>2 hrs<br>2 hrs<br>1 hr |
| 3 | **Integral Calculus** | 3.1 Evaluation of Indefinite Integrals, Definite integrals, Improper Integrals;<br>3.2 Deduce Reduction formula, and solve problems related to Beta Gamma functions. | 2 hrs<br>2 hrs |
| 4 | **Application of Integral** | 4.1 Evaluation of area, arc length,<br>4.2 Evaluation of Surface volume of solid of revolution in the plane for Cartesian and parametric curves. | 1 hr<br>2 hrs |
| 5 | **Partial Differentiation** | 5.1 Prove Euler's theorem for the function of two and three variables<br>5.2 Calculate total derivatives and differentiation of Implicit functions. | 1 hr<br>1 hr |
| 6 | **Application of Partial Differentiation** | 6.1 Evaluation of Extrema of functions of two and three variables and Lagrange's method of undetermined Multipliers (up to 2 multipliers) | 2 hrs |
| 7 | **First Order Ordinary Differential Equations** | 7.1 Solution of separable, homogeneous and exact differential equation Linear, Bernoulli equation and Riccati's equation with engineering applications<br>7.2 Mathematical modeling of engineering problems using first order equation. | 2 hrs<br>1 hr |
| 8 | **Second Order Ordinary Differential Equations** | 8.1 Solve second order homogeneous ODE with constant and variable coefficients, Euler-Cauchy equation.<br>8.2 Solve non-homogeneous second order ODE by undetermined coefficients and variation of parameters in engineering application | 3 hrs<br>2 hrs |

## 6. Evaluation System and Students' Responsibilities

**Evaluation System**
Internal evaluation is done as follows:

| Internal Evaluation | Marks | External Evaluation | Weight | Marks |
|---|---|---|---|---|
| Attendance & Class Participation | 10% | **Semester End Board Examination** | **50%** | 50 |
| Assignments | 20% | | | |
| Presentations/Quizzes | 10% | | | |
| Term exam | 60% | | | |
| Total Internal | 50 | | | |
| Full Marks: 50 + 50 = 100 | | | | |

**Students' Responsibilities**
Each student must secure at least 45% marks in internal evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) and the student will not be eligible to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

## 7. Prescribed Books and References

**Text Books**

1. Kreyszig, E. *Advance Engineering Mathematics,* New Delhi: John Wiley and Sons Inc.
2. Pahari, N.P., Ghimire, S., Kafle, J., Bhandari, A. K. Poudel, M. P, Gurung, P., Ojha, D. (2023). A Textbook of Calculus I. Asmita Publication.
3. Stewart, J. *Calculus, Early Transcendental.* India; Cengage Learning.


**References**

1. Thomas, G. & Finney, R. *Calculus and Analytical Geometry.* New Delhi: Narosa Publishing House.
2. Mishra, P., Mishra, R., Mishra, V. P., & Mishra, M. *Advance Engineering Mathematics.* New Delhi: V. P. Mishra Publication.
3. Dass, H. K. & Verma R. *Higher Engineering Mathematics.* New Delhi: S Chand Publishing.

**Pokhara University**
**Faculty of Science and Technology**

Course No.: ENG 110
Course Title: Communication Techniques (2-2-0)
Nature of the Course: Theory
Level: Bachelor

Full Marks: 100
Pass Marks: 45
Total Periods: 30
Program: BE

## 1. Course Description

This course is designed to offer a comprehensive introduction to first-year engineering students to strategies that will help them create effective technical documents and presentations.

It covers the entire gamut of technical communication in thirteen major parts, namely, thinking about the audience, purpose, and genre; ethical issues; researching; technical writing; designing documents; visual communication; communication in the workplace; writing proposals; reporting information; writing how-to documents; reporting document usability; taking communication online; and presenting communication orally.

This course takes a rhetorical approach to technical communication. This means that instead of setting up a list of rules that students should apply uniformly to all writing situations, this course introduces them to the bigger picture of how the words they write can affect the people intended to use them. By understanding who the readers or users are and what they need in a technical document, students can adapt their knowledge to their situations to provide them with what they need and this will facilitate how to educate themselves as well as facilitate the learning of others. There are also several different kinds of exercises and assignments. in-class exercises are short assignments intended to be done by students in class in 15 or 20 minutes. They ask students to use the main ideas discussed in the previous section and to think critically about those ideas. There are also assignments and major projects, and these group activities further learning through opportunities to work with others, to discuss the course content, and to hear others' bright ideas that might spark greater creativity overall.

## 2. General Objectives

The objectives of the course are to enable students to

- practice technical writing strategies
- apply the concepts that they need to make good decisions about how to write a document
- guide them in developing a good working draft
- test their document with members of the target user group and receive constructive feedback
- present usable information on a specialized (and usually technical) subject
- write technical proposals, reports, and documents
- make oral technical presentations
- communicate in the workplace

**3. Methods of Instruction**

In this course the idea is that students should read the chapter prior to class and, when they get to class, the teacher can quickly summarize for them the main points to which they should pay attention. Then the teacher can assign an exercise that will reinforce the theoretical concept and get students started working with it. There are also several different kinds of exercises and assignments: in-class exercises are short assignments intended to be done by students in class in 15 or 20 minutes, and here students use the main ideas discussed in the previous section and think critically about those ideas: lab assignments are slightly longer than in-class exercises, but they are still intended to be completed (or at least worked on) during a class meeting; the third type of assignment is the major project, which is a longer, more formal assignment that has students consider the main concepts from the chapter (or chapters) to produce an effective example of one of the main genres of technical communication. The teacher can assign the major project at the beginning of a particular unit of study and have it due the following week or at the end of the term, depending on the teacher's course plan and schedule. It is also important to have the students work collaboratively on the in-class and lab assignments. Depending upon the teacher's course goals, they may decide to cover the chapters in the order in which they are presented in the syllabus but they can use the chapters in the order that suits their students' needs and the assignment schedule.

**4. Contents in Detail**

The course is divided into eight units of two weeks each.

| Weeks | Specific Objectives | Course Contents |
|---|---|---|
| 1-2 | Introducing the basic concepts of audience, purpose, and genre; Introducing ethical issues and conducting research | Thinking about audience, purpose, and genre;<br>Leading and misleading the reader:<br>- ethics at work<br>- ethics for students<br>- how is ethics related to technical communication?<br>- researching technical subjects |
| 3-4 | Writing for the workplace; Style in technical prose | Writing email and letters for the workplace;<br>- writing messages: email, memos, letters<br>- writing messages: informative, positive, negative, persuasive<br>- how is ethics related to technical communication<br>Writing technical prose:<br>- clarity, cohesion, conciseness, parallelism |
| 5-6 | Designing technical documents; Incorporating visuals into technical documents | Designing documents and page layout; Communicating through visuals |
| 7-8 | Writing effective proposals; Writing instructional documents | Writing winning proposals;<br>Writing how-to documents:<br>- instructions, procedures, and manuals |

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|---|---|---|
| 9-10 | Testing instructional documents;<br>Reporting technical information, part 1 | Testing and reporting document usability;<br>Reporting technical information:<br>- recommendation reports |
| 11-12 | Reporting technical information, part 2;<br>reporting technical information, part 3 and accessing technical documents online | Reporting technical information:<br>- white papers or information reports;<br>Taking technical communication online:<br>- sharing documents electronically |
| 13-14 | Writing documents to be used online;<br>Status or progress reports | Taking technical communication online:<br>- writing online documents;<br>Reporting technical information:<br>- status or progress reports |
| 15-16 | Presenting technical information orally;<br>Students present some aspect of their major projects | Oral presentation of technical reports;<br>Student presentations of major project |

**5. Evaluation System and Students' Responsibilities**

**Evaluation System**

In addition to the formal exam(s), the internal evaluation of a student may consist of quizzes, assignments, project work, class participation, etc. The tabular presentation of the internal evaluation is as follows.

| Internal Evaluation | Weight | Marks | External Evaluation | Marks |
|---|---|---|---|---|
| Attendance & Class Participation | 10% | | Semester-End Examination | 50 |
| Assignments | 20% | | | |
| Presentations/Quizzes | 10% | | | |
| Term exam | 60% | | | |
| Total Internal | | 50 | | |
| Full Marks: 50 + 50 = 100 | | | | |

**6. Student Responsibilities**

Each student must secure at least 45% marks in internal evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) and the student will not be eligible to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

**7. Prescribed Books and References**

**Text Book**

Graves, H., & Roger, G. *A Strategic Guide to Technical Communication*. 2nd ed., London: Eurospan Group, 2012.

**References**

Greenlaw, R. *Technical Writing, Presentation Skills, and Online Communication: Professional Tools and Insights*. IGI Global, 2012.

Gurak, L. J. & John, M. L. *Strategies for Technical Communication in the Workplace*. 2nd ed., Pearson, 2013.

Kmiec, D. & Bernadette, L. *The IEEE Guide to Writing in the Engineering and Technical Fields*. Wiley, 2017.

Markel, M. *Technical Communication*. 11th ed., Bedford/St. Martins, 2015.

Mirel, B. & Rachel, S. eds. *Reshaping Technical Communication: New Directions and Challenges for the 21st Century*. Lawrence Erlbaum, 2002.

**Pokhara University**
**Faculty of Science and Technology**

Course Code: CMP 112
Course title: Computer Programming (3-1-2)
Nature of the Course: Theory and Practical
Level: Bachelor

Full Marks: 100
Pass Marks: 45
Total Lectures: 45 hours
Program: BE

## 1. Course Description

This course is designed to encompass the fundamental concepts of structured programming and object-oriented programming. It deals with functions, structures and file handling to develop the computer programs. The course will be delivered through the uses of lectures, self-learning by students, exercises and tests.

## 2. General Objectives

To provide the students with the concepts and implement structured and object-oriented programming languages.

## 3. Methods of Instruction

Lecture, Discussion, Readings, Practical works and Project works.

## 4. Contents in Detail

| Specific Objectives | Contents |
|---|---|
| State various types of programming languages | **Unit I: Introduction to Programming Languages (4 hrs)**<br>1.1 Programming Languages- machine-level language, assembly language and high-level language.<br>1.2 Software and its types<br>1.3 Generations of programming languages<br>1.4 Structured programming language |
| Design and develop the algorithms and flowcharts.<br>Understand the use of computer to solve a given problem. | **Unit II: Problem Solving Using Computer (5 hrs)**<br>2.1 Problems Analysis (understanding of the problem, feasibility and requirement analysis)<br>2.2 Design (Algorithm and flowchart)<br>2.3 Coding (compilation and execution)<br>2.4 Testing and debugging<br>2.5 Implementation, Evaluation and Maintenance of computer programs<br>2.6 Program documentation |
| Describe the origin of the C language.<br>Understand the basic constructs of the C language. | **Unit III: The C Language and its Basic Constructs (8 hrs)**<br>3.1 History of C language<br>3.2 Features of C<br>3.3 The C character set<br>3.4 Keywords and Identifiers<br>3.5 Data types |

| | |
|---|---|
| | 3.6 Constants, variables and their declaration<br>3.7 Formatted input/output functions<br>3.8 The C Operators<br>3.9 Control structures- branching statements (if, if-else and switch statements), looping statements (for, while and do-while loop) |
| Apply concepts of arrays and structures to store the homogenous and heterogenous types of data. | **Unit IV: Arrays and Structures in C (5 hrs)**<br>4.1 Arrays (one dimensional and multi-dimensional arrays).<br>4.2 Initialization of arrays and accessing the elements of arrays<br>4.3 Character arrays (strings)<br>4.4 Structure and union. |
| Use the functions and pointers to develop a computer program. | **Unit V: Functions and Pointers in C (9 hrs)**<br>5.1 Functions and their importance<br>5.2 Declaration of a function<br>5.3 Structure of a function and return statement<br>5.4 Library and user-defined functions<br>5.5 Function arguments and return types<br>5.6 Local and global variables<br>5.7 Calling a function- call by value<br>5.8 Pointers, pointer operators and pointer arithmetic<br>5.9 Returning multiple values form functions using pointers. |
| Describe the concept of the object-oriented programming using C++. | **Unit VI: Introduction to C++ (6 hrs)**<br>6.1 Procedure-oriented vs object-oriented programming<br>6.2 Concepts of object-oriented programming (object, class, abstraction, encapsulation, inheritance and polymorphism)<br>6.3 Origin of C++<br>6.4 Features of C++<br>6.5 C++ program structure<br>6.6 Input/output streams<br>6.7 Access specifiers<br>6.8 Objects and accessing data members and member functions<br>6.9 Constructors (default and parameterized) and destructors |
| Use the concept of the object-oriented programming using C++ to develop a computer program. | **Unit VII: Object-Oriented Programming Concepts (8 hrs)**<br>7.1 Inline function<br>7.2 Friend function<br>7.3 Function overloading<br>7.4 Inheritance and its types (single, multiple and multi-level)<br>7.5 Function overriding<br>7.6 Template function<br>7.7 Exception handling |

## 5. Practical Works

Laboratory works of 30 hours per group of maximum 24 students should cover all the concepts of C and C++ languages from all chapters studied in the lectures. Students should develop the algorithm, flowchart and coding to solve the following problems in laboratory:

| SN | Problems to solve |
|---|---|
| 1 | Temperature conversion between degree Celsius and Fahrenheit. |
| 2 | Solve quadratic equation. |
| 3 | Find factorial of n number. |
| 4 | Find the fibonacci series and its terms. |
| 5 | Multiplication, addition and product of two-dimensional matrices and find the transpose and inverse of a two-dimensional matrices. |
| 6 | Use structure to keep the records of books or any other item and access them. |
| 7 | Using the concept of class, create the objects to keep the records of books or any other items. |
| 8 | Implement the single, multiple and multilevel inheritance to solve real world problem. |
| 9 | Implement the template function that works for all data types to perform certain task. |
| 10 | Implement exception handling in C++ with a simple example. |

Students should submit a final project that uses the concepts of C or C++ studied in this course. The marks for the practical will be based on the project work.

## 6. List of Tutorials

The various tutorial activities that suit your course should cover all the content of the course to give students a space to engage more actively with the course content in the presence of instructor. Students should submit tutorials as assignments or class works to the instructor for evaluation. The following tutorial activities of 15 hours per group of maximum 24 students should be conducted to cover the content of this course:

A. Discussion-based Tutorials: (2 hrs)

1. Evolution of Programming languages and its generations (Class discussion)
2. Structured programming and Object-oriented programming paradigms (Class discussion).
3. Purpose and benefits of generic programming (Oral Presentation).

B. Problem solving-based Tutorials: (8 hrs)

4. Develop algorithms and flowcharts to find simple interest, largest number among three numbers, factorial of a number, fibonacci series, prime numbers, temperature conversion, product of matrices.
5. Develop the C programs of the above stated algorithms.
6. Develop the C++ programs to illustrate the concept of inline functions, friend functions, template function and exception handling with simple examples.

C. Review and Question/Answer-based Tutorials: (5 hrs)

7. Case study of "Development of C with the UNIX operating system and origin of C++ languages" followed by Oral Presentation in class.
8. Students ask questions within from the course content and assignments and review key course content in preparation for tests or exams.

## 7. Evaluation System and Students' Responsibilities

### Evaluation System

The internal evaluation of a student may consist of assignments, attendance, internal assessment, lab reports and projects etc. The tabular presentation of the internal evaluation is as follows:

| **Infernal Evaluation** | **Weight** | **Marks** | **External Evaluation** | **Marks** |
|---|---|---|---|---|
| **Theory** | | 30 | Semester-End examination | 50 |
| Attendance & Class Participation | 10% | | | |
| Assignments | 20% | | | |
| Presentations/Quizzes | 10% | | | |
| Internal Assessment | 60% | | | |
| **Practical** | | 20 | | |
| Attendance & Class Participation | 10% | | | |
| Lab Report/Project Report | 20% | | | |
| Practical Exam/Project Work | 40% | | | |
| Viva | 30% | | | |
| Total Internal | | 50 | | |
| Full Marks: 50 + 50 = 100 | | | | |

### Student's Responsibilities

Each student must secure at least 45% marks separately in internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

## 8. Prescribed Books and References

### Text Books


1. Gottfried, Byron S. (2018). *Programming with C.* Tata McGraw-Hill.
2. Lafore, R. (1997). *Object-oriented programming in C++.* Pearson Education.


### References


1. Balagurusamy, E. (2008). *Object oriented programming with C++.* Tata McGraw-Hill.
2. Balagurusamy, E. (2016). *Programming In Ansi C.* Tata McGraw-Hill.

3. Kernighan, B. W., & Ritchie, D. M. (2002). *The C programming language.* Prentice Hall.

**Pokhara University**
**Faculty of Science and Technology**

Course Code: MEC 112
Course Title: Engineering Drawing (0-0-6)
Nature of the Course: Practical
Level: Bachelor

Full Marks: 100
Pass Marks: 45
Total Duration: 90 hours
Program: BE Civil/ Civil & Rural

## 1. Course Description

This course is designed to provide students the knowledge and skills to draw, visualize and represent objects manually as well as with the application of computer aided techniques. The course will be delivered using tutorials and self-learnings by the students.

## 2. General Objectives

The general objectives of this course are:

- To enhance knowledge and skills to draw and visualize geometrical shapes of objects,
- To enable students to draw, visualize and representation objects using Computer aided techniques.

## 3. Methods of Instruction

Lecture, tutorials and assignments

## 4. Contents in Detail

| Specific Objectives | Contents |
|---|---|
| Recognize the drawing instruments, drawing sheets, lettering and dimensioning. | **Unit I: Introduction to engineering drawing (3 hrs)**<br>1.1 Manual drawing instruments, drafting machines, drawing paper and materials, preparation for drawing, cautions in use of instruments, drawing sheets-their layout and planning<br>1.2 Technical lettering and dimensioning: Single-stroke letters, capital and lowercase letters, vertical and slant lettering, vertical and inclined numerals<br>1.3 Procedure for lettering, dimensioning terms and notations, theory of dimensioning, system of dimensioning, use of scales, units and general rules of dimensioning |
| Draw basic geometrical shapes | **Unit II: Geometrical Constructions (10 hrs)**<br>2.1 Construction involving lines and angles, bisecting and trisecting lines and angles, division of lines, proportional division of lines<br>2.2 Construction of polygons, constructions using tangents circles and arcs, open and cross belt tangents<br>2.3 Construction of conic and engineering curves: ellipse, parabola, hyperbola, cycloid, involute, Archimedean spiral, helix. |

| | |
|---|---|
| Recognize and relate projection of points, lines, planes | **Unit III: Descriptive Geometry (10 hrs)**<br>3.1 Projection of points in all quadrants, projections of lines in different positions with respect to the reference planes, true length, angle of inclination of lines with reference plane<br>3.2 Projection of planes: Projection of plane lamina of different geometrical shapes in different positions with respect to the reference plane<br>3.3 Application of descriptive geometry: True length (Auxiliary view method), point view of a line, edge view of an oblique plane, shortest distance from a point to a line, true shape of an oblique plane |
| Visualize objects through orthographic projections | **Unit IV: Multi-view Drawings & Sectional Views (20 hrs)**<br>4.1 Introduction, classification of projections, systems of orthographic projection, first angle projection, third angle projection<br>4.2 Selection of views, ways for making a multiview drawing<br>4.3 Introduction of sectional views, half and full sectional views, offset sectional view, hatching lines |
| Illustrate the surface-development and draw intersection curves | **Unit V: Developments and Intersections (10 hrs)**<br>5.1 Introduction, classification of solids, projection of right solids<br>5.2 Complete developments of truncated right solids (Cylinder, Cone, Pyramid and Prism), frustums of right solids (Cone & Pyramid)<br>5.3 Introduction, classification and nomenclature of intersection curves, Intersection of solids at right angle: cylinder and cylinder, cone and cylinder, pyramid and prism, prism and prism, cylinder and prism |
| Visualize and draw objects through isometric, oblique and perspective drawings | **Unit VI: Isometric, Oblique and Perspective Projections (15 hrs)**<br>6.1 Introduction of Axonometric projection, isometric projection, methods and procedure for making an simple isometric drawing<br>6.2 Introduction of oblique projection and oblique drawing, examples for making an simple oblique drawing<br>6.3 Terms used in perspective projection, position of object, construction of one-point and two-point perspective |
| Recognize symbols and assembly drawings | **Unit VII: Symbols and Assembly Drawing (12 hrs)**<br>7.1 Standard symbols like stone, brick masonry, sanitary fixture, structural, building drawings, etc. focusing with civil engineering<br>7.2 Introduction to assembly drawing, assembly drawings: drawing layout, bill of materials, drawing numbers<br>7.3 Practices of detail and assembly drawing particularly focusing on civil engineering related simple machinery parts |

| | |
|---|---|
| Use computer aided techniques to visualize and draw objects | **Unit VIII: Computer Aided Drawing for Civil Engineering (10 hrs)**<br>8.1 Introduction to AutoCAD<br>8.2 Basic commands for 2D drawing like: Line, Circle, Polyline, Rectangle, Hatch, Fillet, Chamfer, Trim, Extend, Offset, Dim style, etc.<br>8.3 Basics of 3D drawings, simple building layout with views for project work for exercises (In computer laboratory with only demonstration and practices) |

**5. Laboratory Work** (90 hours for a group of maximum 24 students)
Lettering and use of drawing instruments; Dimensioning; Geometrical and Projection drawing; Descriptive geometry; Multiview drawings; Sectional views, Development of surfaces and intersections; Axonometric projection; Symbols; Assembly drawings and AutoCAD Drawing.

## 6. Evaluation System and Students' Responsibilities

### Evaluation System

The evaluation of a student may consist of attendance, assignments, term-exams, projects etc. The final examination will be held by the PU Examination Controller's Office. The internal and external evaluation detail is given in the table below:

| Internal Evaluation | Weight | Marks | External Evaluation | Marks |
|---|---|---|---|---|
| **Practical** | | | | |
| Attendance and Class Participation | 10% | | Semester-End examination | 50 |
| Drawing Sheets Evaluation | 30% | | | |
| Assignment | 10% | | | |
| Internal Assessment | 50% | | | |
| Total Internal | | 50 | | |
| Full Marks: 50 + 50 = 100 | | | | |

### Students' Responsibilities

Each student must secure at least 45% marks separately in internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

## 7. Prescribed Books and References

### Text Books


1. Luzadder, W. J. & Duff, J. F (2015). *Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production.* Pearson India Education Services.
2. *Luintel, M.C. (2018). Engineering Drawing I.* Heritage Publishers & Distributors Pvt. Ltd. Kathmandu.

**References**


1. Gill, P. S. (2009). *Engineering Drawing*. Seagull Books Pvt Ltd.
2. Dhawan, R. K. (2019). *A Textbook of Engineering Drawing*. S. Chand Publishing.
3. Omura, G. (2012). *Mastering AutoCAD 2013 and AutoCAD LT 2013*. John Wiley & Sons.