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)** 1.1 Free oscillation, Damped oscillation and Forced oscillation (Physical meaning and equations). 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)** 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.)** 3.1 Classification of sound waves, Acoustics of building, Reverberation of sound, absorption coefficient, Noise

related to ultra sound.	pollution and its control, Sound insulation, Sabine equation. 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.)** 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. 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. Solve problems related to electrostatics.	**Unit V: Capacitor and Dielectric (6 hrs.)** 5.1 Capacitor: Introduction, Types of capacitors, Charging and discharging of capacitor. 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. Analyze the relationship between electric field, magnetic field and speed of wave.	**Unit VI: Electromagnetism (6 hrs.)** 6.1 EM Oscillation: LC oscillation, Damped LCR oscillation, Forced electromagnetic oscillation, resonance and quality factor 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.)** 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. Solve the problems related to	**Unit VIII: Fundamentals of Thermodynamics and Heat Transfer (8 hrs.)** 8.1 Concepts and definition: applications of

thermodynamics and heat transfer.	thermodynamics, properties and state of substance, thermodynamics properties and types, processes (definition, characteristics and examples): reversible and irreversible process. 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. 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.

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 Code: ELE 120
Course title: Basic Electrical Engineering (3-2-2)
Nature of the course: Theory and Practical
Level: Bachelor

Full marks: 100
Pass marks: 45
Total lectures: 45 hours
Program: BE (Computer, IT)

1. Course Description

This course covers the various concepts of electrical circuits, theorems as well as the concepts of electrical machines. This course emphasizes on fundamental concept, principles and properties of electrical circuits, circuit parameters and its application. It also covers the concepts of DC and AC electrical circuit analysis and electrical machine.

2. General Objective

The general objectives of this course are:

- To acquaint the students with AC and DC electric circuits, steady state behavior of single phase and three phase AC electrical circuits.
- To make the students able to distinguish and use electrical devices and machines.

3. Methods of Instruction

Lecture, Discussion, Readings, Practical works, Project works

4. Contents in Detail

Specific Objectives	Contents
• Describe the generation, transmission, distribution and use of electrical energy.	**Unit I: Introduction (2 hrs)** 1.1 Role of electricity in modern society 1.2 Energy sources and production 1.3 Generation, transmission and distribution of electrical energy 1.4 Consumption of electricity
• Evaluate voltages and currents across the electric circuits using voltage and current divider rule. • Use Kirchhoff's laws to evaluate current and voltage in DC circuits. • Obtain the equations for DC electric circuits using mesh and nodal analyses and solve them to evaluate current(s)/voltage(s). • Explain and use network theorems to reduce a DC circuit to a simple equivalent.	**Unit II: DC Circuit Analysis (15 hrs)** 2.1 Circuits concepts (lumped and distributed parameters), linear and nonlinear parameter, passive and active circuits 2.2 Circuit elements (Resistance, capacitance and inductance), their properties and characteristics in a geometrical and hardware aspects 2.3 Color coding, Series of parallel compilation of resistances, Equivalent resistance and its calculation, star-delta transformation 2.4 Concept of power, energy and its calculations 2.5 Short and open circuit 2.6 Ideal and non-ideal sources, source conversion 2.7 Voltage divider and current divider formula 2.8 Kirchhoff's current and voltage laws 2.9 Nodal method and mesh method of network analysis (without dependent source)

	2.10 Network theorem (Superposition, Thevenin's, Norton's, maximum power transfer theorem)
• Explain generation of single-phase alternating quantities and its characteristics. • Calculate average and root-mean-square values of alternating voltage(s)/current(s). • Analyze the steady state behavior of single-phase AC electric circuits.	**Unit III: Single Phase AC Circuits Analysis (10 hrs)** 3.1 Generation of three phase alternating quantity and Concept of a balanced three phase supply Generation of EMF by electromagnetic induction, Generation of alternating voltage 3.2 Sinusoidal functions-terminology (phase, phase angle, amplitude, frequency, peak to peak value), average values and RMS or effective value of any types of alternating voltage or current waveform 3.3 Phase algebra, power triangle, impedance triangle, steady state response of circuits (RL, RC, RLC series and parallel) and concept about admittance, impedance, reactance and its triangle), instantaneous power, average real power, reactive power, power factor and significance of power factor 3.4 Resonance in series and parallel RLC circuit, bandwidth, effect of Q factor in resource
• Explain generation of poly phase alternating quantities and its characteristics. • Analyze the steady state behavior of three phase AC electric circuits. • Describe the measurement of three phase power.	**Unit IV: Poly-phase AC Circuit Analysis (6 hrs)** 4.1 Generation of three phase alternating quantity and Concept of a balanced three phase supply 4.2 Differences between single phase and three phase system 4.3 Star and delta connected supply and load circuits., Line and phase voltage/current relations, power measurement 4.4 Concept of three phase power and its measurement by single and two wattmeter methods
• Analyze the difference between electric and magnetic circuits. • Explain the working principle of single-phase two-winding transformer. • Analyze open circuit and short circuit tests of single-phase two-winding transformer. • Explain the performance and operation of DC machines • Explain the construction, working principle and use of induction motors.	**Unit V: Electrical Machines (12 hrs)** 5.1 Differences and similarities between electric circuit and magnetic circuit 5.2 Transformers: Principle of operations, features, equivalent circuits, efficiency & regulation, open circuit & short circuit tests of single phase two winding transformer 5.3 DC generator: Construction features, working principles, basic characteristics 5.4 DC motors: Performance & operation, basic characteristics, speed control & selection of motors 5.5 AC machines: Single phase and three phase induction motors (working principles, construction features and uses)

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	Discussion-based Tutorials
2	DC circuit analysis (star/delta conversion, mesh analysis, nodal analysis, superposition theorem, Thevenin's theorem, Norton's theorem and Maximum power transfer theorem
3	Single phase ac circuits
4	Analysis of three phase ac circuits
5	Single-phase Transformer, dc motor, dc generator

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

S.N.	Practical Works
1	To measure current, voltage and power across the passive components.
2	To verify Kirchhoff's Current Law (KCL) & Kirchhoff's Voltage Law (KVL)
3	To verify Thevenin's Theorem.
4	To verify maximum power transfer theorem.
5	To verify superposition theorem.
6	To measure three phase power by using two wattmeter
7	To determine efficiency and voltage regulation of a single-phase transformer by direct loading.
8	To study open circuits & short circuits tests on a single-phase transformer
9	To study the speed control of dc shunt motor by. -Varying the field current with armature voltage held constant field control. -Varying the armature voltage with field current held constant armature control.
10	To study open circuits and load test on a dc shunt generator (separately excited) -To determine magnetization characteristics -To determine V-I characteristics of a dc shunt generator

7. Evaluation system and Students' Responsibilities

Evaluation System

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

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

Full Marks: 50 + 50 = 100

Student's Responsibility

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. Boylestad, R. L. (2013). *Introductory circuit analysis*. Pearson Education India.
2. Theraja, B. L. (2008). *A textbook of electrical technology*. S. Chand Publishing. India.

References

1. Jain & Jain (2013). *ABC of Electrical Engineering*. Dhanpat Rai Publishing Company, India.
2. Tiwari, S.N. (1993). *A first course of electrical engineering*. A.H. Wheeler & Co. Ltd. Allahabad, India.

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)** 1.1 Introduction 1.2 Limit, continuity and differentiability 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)** 2.1 Mean value theorems: Rolle's theorem, Lagrange's Theorem (Geometrical interpretation and verification) and applications 2.2 Higher order mean value theorem: Taylor's Series, Maclaurin's Series expansion of function. 2.3 Asymptotes to Cartesian curves up to four degrees. 2.4 Curve tracing in Cartesian form and parametric form 2.5 Curvature
• Evaluate Proper and improper integrals.	**Unit III: Integral Calculus (6 hrs)** 3.1 Introduction 3.2 Review on Indefinite Integral and fundamental theorem of integral calculus.

	3.3 Definite integral and its properties 3.4 Improper Integrals; comparison test. 3.5 Reduction formula, Beta Gamma functions
• Evaluate arc length, area, and volume through integration.	**Unit IV: Application of Integral (6 hrs)** 4.1 Application of integrals for finding area beneath a curve and between two curves and arc length 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)** 5.1 Introduction 5.2 Partial Derivatives 5.3 Homogeneous function and Euler's theorem for the function of two and three variables 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)** 6.1 Extrema of functions of two and three variables. 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)** 7.1 Review of separable, homogeneous and exact differential equation with engineering applications 7.2 Linear, Bernoulli equation and Riccati's equation with engineering application. 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)** 8.1 Second order Homogeneous ODE with constant and variable coefficients, Euler-Cauchy equation. 8.2 Existence and uniqueness of solutions, Wronskian and general solutions for solving ODE. 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. 1.2 Show that differentiability implies continuity but the converse may not be true 1.3 Evaluation of higher order derivatives by Leibnitz method	1 hr 1 hr 1 hr
2	**Applications of Derivatives**	2.1 Problems in Mean value theorems: Rolle's theorem, Lagrange's Theorem 2.2 Expand the functions through Taylor's Series, and Maclaurin's Series 2.3 Evaluation of Asymptotes to Cartesian curves. 2.4 Trace Curve for the equations in Cartesian form and parametric form 2.6 Problems in Curvature	1 hr 2 hrs 2 hrs 2 hrs 1 hr
3	**Integral Calculus**	3.1 Evaluation of Indefinite Integrals, Definite integrals, Improper Integrals; 3.2 Deduce Reduction formula, and solve problems related to Beta Gamma functions.	2 hrs 2 hrs
4	**Application of Integral**	4.1 Evaluation of area, arc length. 4.2 Evaluation of Surface volume of solid of revolution in the plane for Cartesian and parametric curves.	1 hr 2 hrs
5	**Partial Differentiation**	5.1 Prove Euler's theorem for the function of two and three variables 5.2 Calculate total derivatives and differentiation of Implicit functions.	1 hr 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 7.2 Mathematical modeling of engineering problems using first order equation.	2 hrs 1 hr
8	**Second Order Ordinary Differential Equations**	8.1 Solve second order homogeneous ODE with constant and variable coefficients, Euler-Cauchy equation. 8.2 Solve non-homogeneous second order ODE by undetermined coefficients and variation of parameters in engineering application	3 hrs 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. 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 Code: ELX 120
Course title: Electronic Devices and Circuits (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

The purpose of the course is to provide the fundamental concept of semiconductor and their application in electronics devices. Furthermore, this course provides the idea of analyzing and designing electronic device and circuits.

2. General Objectives

The course is designed with the following general objectives:

- To provide the concept of semiconductor diode and their application in dc power supply, clipper and clamping circuits
- To familiarize the students with construction, working principle, and characteristics of different types of transistors and their application.
- To make the students competent in analyzing and designing the different electronic circuits.

3. Methods of Instruction

Lecture, Tutorial, Discussion, Readings and Practical works

4. Course in Detail

Specific Objectives	Contents
• Explain the basic concept of p-n junction and their implementation on diode and Zener diode.	**Unit I: Semiconductor Diode (5 hrs)** 1.1 Introduction to insulator, semiconductor and conductors 1.2 Conduction principle in semiconductors, electrons and holes, donor and acceptor impurities, n-and p-type semiconductors 1.3 p-n junction: formation of space-charge region, energy band structure and barrier potential 1.4 The p-n junction under forward bias and reverse bias, characteristic curve and temperature effect 1.5 Junction breakdown, Junction and diffusion capacitances 1.6 Diode switching times 1.7 Construction, characteristics and

	applications of Zener diode
• Explain the importance of bipolar transistors in modern electronic circuits • Describe the construction, working principle and characteristics of bipolar transistors • Discuss the DC/AC load line and Q-point in BJT and analyze the different method of BJT biasing circuits	**Unit II: Bi-polar Junction Transistor (6 hrs)** 2.1 Introduction of bipolar junction transistor (BJT) 2.2 Construction and working principle of different types of BJT, Mode and configuration in BJT 2.3 Current gain of BJT at different configuration and their relationship 2.4 Input and output characteristics of transistor 2.5 Comparison of CB, CE and CC configurations 2.6 Biasing and different methods of biasing, DC/AC load line and Q-point in BJT 2.7 The transistor as an amplifier and switch, BJT switching times 2.8 Concept of bias stabilization and stability factor
• Explain and analyze the different types of rectifiers • Discuss and analyze filter, and regulators circuit • Explain and analyze the operation of clipping and clamping circuits	**Unit III: DC Power Supply (5 hrs)** 3.1 Rectifier and their types, average value, RMS value, ripple factor, efficiency 3.2 Filtering process and Shunt capacitor 3.3 Clipper and clamping circuits 3.4 Power supply: Regulated and unregulated power supplies 3.5 Transistor series and transistor shunt regulators
• Describe the construction, working principle and characteristics of FET and MOSFET • Discuss and analyze the DC load line of different FET biasing circuits • Visualize the concept of small signal model in JFET	**Unit IV: The Field Effect Transistor (FET) (4 hrs)** 4.1 Comparison between FET and BJT 4.2 Construction and working principle of JFET 4.3 Drain and transfer characteristics of JFET and JFET parameters 4.4 Biasing circuits and DC load line 4.5 Construction and working principles of DMOSFET and EMOSFET
• Explain the concept of AC analysis of BJT • Apply the small signal low frequency analysis models using r_e model of transistor in different transistor configurations	**Unit V: The Small Signal Low Frequency Analysis Model of BJT (6 hrs)** 5.1 Introduction and basic concept of AC analysis of BJT 5.2 r_e model of BJT, amplifier configuration and their expression for voltage gain, current gain, input impedance and output

	impedance using r_e model 5.3 Analysis of transistor amplifier circuit using r_e model 5.4 Emitter follower
• Visualize the concept of multistage amplifier and various coupling methods. • Analyze multistage amplifier in term of voltage gains, Current gains, input and output impedance using r_e model • Explain the Darlington-pair amplifier and calculate its effective beta	**Unit VI: Multistage Amplifiers (4 hrs)** 6.1 Multistage amplifier and its importance, methods of coupling 6.2 Gain calculation of n-stages cascaded amplifiers 6.3 Expression of voltage gains, current gains, input and output impedance for two stages RC coupled amplifier using r_e model 6.4 Choice of configuration in a cascade 6.5 Darlington-pair amplifier and its effective beta
• Define the concept of large signal amplifier • Explain the operating principle and analyze the power conversion capabilities of different classes of Amplifiers with its merits and demerits • Visualize the concept of push-pull amplifiers and transformer coupled push-pull amplifier	**Unit VII: Large Signal Amplifiers (4 hrs)** 7.1. Large signal amplifier and its importance 7.2. Analysis of Class A, B, and AB amplifier 7.3. Push-pull amplifiers and Transformer coupled push-pull amplifier 7.4. Cross over distortion 7.5. Amplifier efficiency, power dissipation and heat sinks
• Explain negative and positive feedback amplifier with its importance • Design RC and LC oscillator using Op-amp	**Unit VIII: Feedback Amplifiers (7 hrs)** 8.1. Classification of feedback amplifier 8.2. Negative feedback amplifiers and advantages of negative feedback (gain, stability, extension of bandwidth, signal to noise ratio, input and output impedances) 8.3. Importance of positive feedback on oscillation 8.4. Barkhausen criteria for oscillation 8.5. RC and LC oscillator using Op-amp 8.6. Multivibrators: Astable and monostable

• Visualize the operational amplifiers and its properties • Explain type of amplifier (Inverting and non-inverting) and apply its application in operational amplifier.	**Unit IX: Operational Amplifier (4 hrs)** 9.1. Basic Model 9.2. Ideal and non-ideal properties 9.3. Virtual ground concept and CMRR 9.4. Inverting and non-inverting amplifier 9.5. Summing, Integrator, and differentiator amplifier 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	Numerical related to Zener diode as a voltage regular
2	Numerical related to current gain, biasing circuits, DC/AC load line and Q point in BJT.
3	Numerical related to clipper and clamping circuits.
4	Numerical related to biasing circuits (DC load line, Q point) of JFET.
5	Numerical related to r_e modeling of different BJT amplifier configuration to calculate voltage gain, current gain, input impedance and output impedance.
6	Numerical related to calculation of voltage gain, current gain, input impedance and output impedance for two stages RC coupled amplifier using r_e model.
7	Numerical related to analysis of Class A, B, and AB amplifiers.
8	Numerical related to negative feedback amplifiers and design of RC and LC oscillator using Op-amp.
9	Numerical problems related to design of operational amplifier.

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

S.N.	Practical Works
1	Familiarization with different basic components and measuring tools.
2	Study of V-I Characteristics of different PN junction diodes
3	Study of rectification characteristics of half-wave and full-wave rectifier.
4	Study of clipper and clamper circuits.
5	Study of Zener diode characteristic as voltage regulator
6	Study of input and output characteristics of CE and CB transistor amplifier.
7	Study of drain and transfer characteristics of JFET
8	Study of drain and transfer characteristics of MOSFET
9	Measurement of gain in single stage and multistage amplifiers.
10	Measurement of efficiency of class A and Class B push pull power amplifiers.
11	Design of RC and LC oscillator using Op-amp and their verification.
12	Measurement of regulation in series regulator against change in input voltage and load resistance.

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 and class participation. 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 Responsibility

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. Bogart, T. F. Beasley, J. S. & Rico, G. (2004). *Electronic devices and circuits* (6th ed.). Pearson Education
2. Boylestad, R. & Nashelsky, L (2012) *Electronic devices and circuit theory* (11th ed.). Prentice Hall, India.

References

1. Sedra, A. S. & Smith, K. C. (2004). *Microelectronic circuits* (5th ed.). Oxford University Press, New York.
2. Millman, J. Halkias, C. C. & Jit, S. (2010). *Milman's electronics devices and circuits* (3rd ed.). Tata McGraw Hill Education.

Pokhara University
Faculty of Science and Technology

Course No.: MTH 120
Course title: Problem Solving Techniques (3-1-0)
Nature of the course: Theory
Level: Bachelor

Full marks: 100
Pass marks: 45
Time per period: 1 hour
Total Periods: 45
Program: BE (IT, Software)

1. Course Description

Many everyday activities involve problem solving using some kinds of techniques. In order to solve the problems, one must think analytically to find a solution of the problem. This course is designed to provide the students with the basic principles of problem solving techniques that include both mathematical problems and non-mathematical problems. It deals with methodology of analytic thinking and finding appropriate techniques to solve a given problem.

2. General Objectives

The general objectives of this course are:

- To acquaint the students with the conceptual clarity in thinking analytically and logically to solve real-life problems.
- To provide the students with the knowledge of fundamental approaches of how to translate verbal discussion onto analytical data and then how to solve it by computer.

3. Methods of Instruction

Lecture, Discussion, Readings and Case Study.

4. Contents in Detail

Specific Objectives	Contents
• State various types of mathematical and non-mathematical problems.	**Unit I: Basic Concepts of Problem Solving (6 hrs)** 1.1 A First Problem 1.2 How to count 1.3 The Use of Induction 1.4 Problem of logics 1.5 Issues of Parity

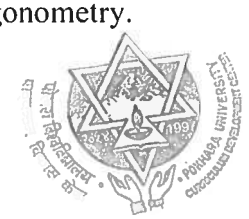
• Use the concept of geometry in solving real world problems.	**Unit II: Application of Geometry (6 hrs)** 2.1 Classical Planer Geometry 2.2 Analytic Geometry 2.3 Miscellaneous and Exotic Geometry Problems 2.4 Solid Geometry
• Deduce the solutions to the problems that need to think analytically and logically.	**Unit III: Miscellaneous Problem-Solving Techniques (10 hrs)** 3.1 Probabilistic Approach to Solving Counting Problems 3.2 Logic Problems • Simple Logic • Theory of Games • Tracing Routes • Learning from Parity • Mysterious Arithmetic Problems • Surprise 3.3 Problems from Recreational Math • Magic Square • Weighing Problems 3.4 Problems of Algebra and Analysis • Inequality • Trigonometry and related ideas
• Apply mathematical concept to solve real-life problems.	**Unit IV: Solving Miscellaneous Real-Life Problems (8 hrs)** 4.1 Miscellaneous Problems 4.2 Impossible Problems 4.3 Problems from Everyday Life 4.4 Statistics

5. List of Tutorials

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

A. Problem solving-based Tutorials: (9 hrs)

1. Solve problems related to counting(Counting number of zeros in factorial or in given expression, handshaking problem,)
2. Verify mathematical formulas using mathematical induction.
3. Solving problems related with analytic and solid geometry.
4. Solving problems related with game theory, weighing and magic square.
5. Solving problems of counting using a probabilistic way.
6. Solving problem of tracing routes.
7. Solving problems related to inequality and trigonometry.
8. Solving problem related to everyday life.
9. Solving problems related with statistics.



B. Review and Question/Answer-based Tutorials: (6 hrs)

1. Case study of "Impossible problems" followed by Oral Presentation in class.
2. Students ask questions within from the course content and assignments and review key course content in preparation for tests or exams.

5. Evaluation System and Students' Responsibilities

Evaluation System

The internal evaluation scheme for this course is as follows:

Internal Evaluation	**Weight**	**Marks**	**External Evaluation**	**Marks**
Theory		50	Semester-End examination	50
Attendance & Class Participation	10%			
Assignments	20%			
Presentations/Quizzes	10%			
Internal Assessment	60%			
Total Internal		50		
Full Marks: 50 + 50 = 100				

Student Responsibilities

Each student must secure at least 45% marks in internal assessment 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.

6. Prescribed Books and References

Text Book

1. Krantz, S. G. (1997). *Techniques of problem solving*. Universities Press.

References

1. Etter, D. M. (1994). *Engineering problem solving with ANSI C: fundamental concepts.* Prentice-Hall, Inc..
2. Lakatos, I. (1976). *Proofs and Refutation The Logic of Mathematical Discovery.* Cambridge University Press.
3. Polya, G. (2004). *How to solve it: A new aspect of mathematical method.* Princeton university press.

Pokhara University
Faculty of Science and Technology

Course No.: CMP 124

Course title: **Programming in C (3-1-3)**

Nature of the course: Theory & Practical

Level: Bachelor

Full marks: 100

Pass marks: 45

Total Lectures: 45 hrs

Program: BE (Computer, IT and Software)

1. Course Description

This course is designed to develop the skills in students to use the C language, which follows the structured programming paradigm, to develop the computer programs. It introduces the different generations of programming languages, the origin, strengths and basic constructs of the C language. After completion of this course, the students will be able to use the C language to resolve a given problem through the problem solving steps- problem analysis, design of algorithm and flowchart, coding using the C language, executing and compiling the developed program, testing and debugging the program and finally well documenting the program for the future understanding.

2. General Objectives

- To acquaint the students with basic knowledge of computer language and generations of programming languages.
- To develop the skills in students to solve a given problem using computer program.
- To acquaint the students with the knowledge of structured programming paradigm (using the C language) to develop the computer programs.

3. Methods of Instruction

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

4. Contents in Detail.

Specific Objectives	Contents

- Explain, compare and classify programming languages and its generations. - Explain and compare the types of software. - Design and develop algorithms and flowcharts. - Familiarize with computer program documentation.	**Unit 1: Programming languages and problem solving (6 hrs)** 1.1 Programming Languages (machine-level language, assembly language and high-level language) and its generations. 1.2 Software and its types 1.3 Structured programming 1.4 Problem solving using computer- Problems Analysis (understanding of the problem, feasibility and requirement analysis), Design (Algorithm and flowchart), Coding (compilation/interpretation and execution), Testing and debugging, Implementation, Evaluation and Maintenance of computer programs, Program documentation
- Describe the origin of the C language and know its strength. - Understand the basic constructs of the C language.	**Unit 2: Introduction to C (6 hrs)** 2.1 History of C language 2.2 Features of C 2.3 The C as a middle-level language 2.4 The C as a system programming language 2.5 The C character set 2.6 Keywords and Identifiers 2.7 Data types 2.8 Constants, variables and their declaration 2.9 Formatted input/output functions 2.10 The C Operators
- Understand and implement the various control structures of the C language.	**Unit 3: Control Structures (6 hrs)** 3.1 Introduction and types of control statements- sequential, branching and looping statements 3.2 Branching statements- simple if statement, if-else, nested if, if-else-if ladder and switch statements 3.3 Looping statements- for loop, while loop, do-while loop, nested loop 3.4 The break, continue and goto statements

- Develop the C program that uses the various types of single and multi-dimensional arrays.	**Unit 4: Arrays and Strings (6 hrs)** 4.1 Introduction to arrays 4.2 One dimensional and Multidimensional arrays 4.3 Initialization of arrays and accessing the elements of arrays 4.4 Strings- the character arrays 4.5 Functions related to the strings
- Design and develop the C programs using functions.	**Unit 5: Functions (6 hrs)** 5.1 Introduction 5.2 Importance of functions 5.3 Returning a value from a function and sending a value to a function 5.4 Function prototypes 5.5 Calling a function- Call by value and Call by reference 5.6 Recursive functions 5.7 Passing an array to a function 5.8 Local variables, formal parameters and global variables 5.9 Storage classes 5.10 Pre-processor directives- C libraries, macros and header files
- Use the pointers in arrays, functions and programs to dynamically allocate and deallocate memory.	**Unit 6: Pointers (6 hrs)** 6.1 Introduction 6.2 Pointer operators 6.3 Pointer arithmetic 6.4 Returning multiple values form functions using pointers 6.5 Pointers and Arrays 6.6 Double indirection 6.7 Dynamic memory allocation

- Use the structures and unions to store and access the heterogenous data required in a program.	**Unit 7: Structure and Union (5 hrs)** 7.1 Definition of Structure 7.2 Nested-Structure 7.3 Array of Structure 7.4 Structures and Pointers 7.5 Union 7.6 Self-referential structure
- Use the C file handling concepts to store the data permanently in a computer file and access them whenever required.	**Unit 8: Files and File Handling (4 hrs)** 8.1 FILE pointer, File opening modes (read, write, append) 8.2 File handling functions 8.3 Creating and operating a file in different modes

5. **Practical Works**

Laboratory works of 45 hours per group of maximum 24 students should cover all the concepts of C language studied in the lectures. Students should submit a final project that uses all the constructs and features of C studied in this course. The marks for the practical work will be based on the project work.

6. List of Tutorials:

The various tutorial activities that suits this course should cover all the content of this course to give student 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. Software and its types.
3. Generations of programming languages.
4. Structured programming. (Oral Presentation).

B. Problem solving-based Tutorials: (10 hrs)

1. Develop algorithms and flowcharts to solve various problems such as to find largest number among three numbers, prime numbers, temperature conversion, product of matrices, finding sum of the terms in series, printing various patterns etc.
2. Develop the C programs for the problems for which you developed the algorithms.
3. Write a program to pass an array to a function.
4. Write a program to use pointers to pass multiple values from a function.
5. Write a program to use the basic string functions to manipulate string data.

6. Write a program to use the principle of recursion to solve the complex problems such as to find factorial of a number, fibonacci series.
7. Write a program to illustrate the macros and header files.
8. Write a program to to illustrate how memory is allocated and deallocated in C language.
9. Write a program to use the nested structure. Discuss the scenarios when the structures and unions are used in real practice.
10. Write a program to solve simple file handing problems.

C. Review and Question/Answer-based Tutorials: (3 hrs)

1. Case study of "Development of C with the UNIX operating system and origin of C++ languages" followed by Oral Presentation in class.
2. 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**

Internal Evaluation

The internal evaluation of a student may consist of assignments, attendance, internal assessment, lab reports and project works etc. The internal evaluation scheme for this course 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 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. Balagurusamy, E. (2016). *Programming In Ansi C.* Tata McGraw-Hill.
2. Gottfried, Byron S. (2018). *Programming with C.* Tata McGraw-Hill.

References:

1. Kelley A. & Pohl I.(2001). *A Book on C, Programming in C.* Addison-Wesley.
2. Kernighan, B. W., & Ritchie, D. M. (2002). *The C programming language.* Prentice Hall.