FINAL

Pokhara University
Faculty of Science and Technology

Course No.: ARC 150 (2 Credits)
Course title: Building Technology (2-0-2)
Nature of the course: Theory & Practical
Level: Bachelor

Full marks: 100
Pass marks: 45
Total lectures: 30 hrs
Program: BE

1. Course Description

This course is designed to equip students with the fundamental knowledge and skills required to design, construct, and manage building projects. Students will learn about various construction materials, techniques, and technologies. Through hands-on projects, case studies, and field trips, students will gain practical experience and develop critical thinking and problem-solving skills.

2. General Objectives

The general objectives of this course are:

- To provide students with a comprehensive understanding of building technology and construction practices.
- To develop students' ability to analyze, design, and manage building technology.
- To enable students to evaluate and select appropriate construction materials, techniques, and technologies.

3. Methods of Instruction

The course will consist of lectures, tutorials, discussions, and hands-on project works.

4. Contents in Detail

Specific Objectives	Contents
Describe the concept of Building sub-structures and technology	**Unit I: Foundations and Basements (4 hrs)** 1.1 Introduction to building components, Function of Foundation and Essential requirements a Foundation 1.2 Types of Foundation, Site investigation and methods of site exploration. 1.3 Some common problem with existing foundations and their remedies. 1.4 Retaining properties and methods of water proofing of basement 1.5 Damp proof Course. 1.6 Earthquake effects on foundation
Define the basic understanding of masonry and its function	**Unit II: Masonry (3 hrs)** 2.1 Types of Masonry 2.2 Brick masonry and Block masonry (Types and Specification) 2.3 Bonds in Brick. 2.4 Types of Brick wall 2.5 Stone masonry (Types and Specification) 2.6 Composite masonry

FINAL

Define the Vertical transportation ,Floors and Roof	**Unit III: Floors, Vertical Transportation and Roof (4 hrs)** 3.1 Floors and its types. 3.2 Different types of vertical transportation (ladder, ramps, Lift and escalators) 3.3 Stair and its elements. 3.4 Essential requirements and Types of staircase. 3.5 Roof and types of roof 3.6 Timber roofs (Single roof, Double roof and triple roof) 3.7 Steel trusses and their components. 3.8 Roof coverings. (Types and construction detail)
Distinguish between different types of Doors and Windows	**Unit IV: Openings (2 hrs)** 4.1 Doors: Types of door and details 4.2 Windows: Types of windows and details 4.3 Ventilators: Types of ventilators and details 4.4 Hardwares for doors, windows and ventilators. 4.5 Lintels and Arches (Types and details)
Describe the Types of joints and construction detail in Load bearing structure and Framed structure	**Unit V: Joints (3 hrs)** 5.1 Types of joints: expansion joint, Contraction joints, Construction joints, Sliding joins and Isolation joints 5.2 Treatment and detailing of joints at the roof level 5.3 Treatment and detailing of joints at the floor level 5.4 Treatment and joints in external walls 5.5 Treatment and joints in Shear wall
Describe Types of Temporary structures and their details	**Unit VI: Temporary Construction (3 hrs)** 6.1 Scaffolding: Types of scaffolds and details 6.2 Timbering for excavations and trenches 6.3 Formworks for reinforced concrete construction 6.4 Shoring: horizontal, slant and vertical shores.
Explain External finishing and cladding details	**Unit VII: Cladding and External finishing (3 hrs)** 7.1 Cladding for load bearing and framed structures 7.2 Brick and stone facing 7.3 Cladding in concrete panels and their construction details 7.4 Plastering, punning and pointing 7.5 Properties and application of paints
Define Types of suspended ceilings and partitions	**Unit VIII: Internal Finishing (2 hrs)** 8.1 Partitions: types, functions and methods of construction 8. 2 Mobile partitions (Details) 8.3 Suspended and false ceilings: types, functions and methods of construction
Describe the Internal water supply system in building structure Explain the Electrical services required in buildings	**Unit IX: Water Supply and Drainage (4 hrs)** 9.1 Mains of water supply: storage and distribution system 9.2 Hot water supply 9.3 Drainage of sewage and waste 9.4 Rainwater pipes and gutters 9.5 Septic tanks and Soak pit 9.6 Rainwater harvesting

FINAL

	Unit IX: Electrical Services (2 hrs) 10.1Residential and commercial requirements 10.2General principles 10.3Wiring system 10.4Trunkings, busbars and ducts for electrical distribution 10.5Safety precautions 10.6Intake structures and provisions

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

5. Tutorials

Tutorials will provide basic calculations relevant to the content covered in lectures.

6. Hands on Project Work (15 hours for a group of maximum 24 students)

The students will be required to conduct a project work that involves observing building technology in real buildings, drawing technical details, and providing comments on the functioning principles. That may include but not limited to following contents

- Plans, elevations, and sections of the building
- Trench plan and footing detail, Doors and window detail
- Details of basement waterproofing, Construction details of the roof
- Water supply and drainage system, including septic tank and soak pit
- Staircase plan and section, Treatment of expansion joints

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**	**Semester End**	**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%			

FINAL

Viva	30%			
Total Internal		**50**		
Full Marks: 50 + 50 = 100				

Student's Responsibilities
To be eligible for the Semester End Examination, students must obtain a minimum of 45% marks in internal assessment and practical evaluation, with 80% attendance in class. Failure to meet this requirement will result in a NOT QUALIFIED (NQ) status. It is recommended that students attend all classes, exams, and complete assignments on time to fulfill the course requirements.

8. Prescribed Books and References

Text Books

1. Chudley, R. (1987). *Construction Technology*, Longman Scientific and Technical, Harlow, England
2. Punmia, B.C., Jain, Ashok K. & Jain, ArunK. (2008), *Building Construction*,Laxmi Publications (P) Ltd., New Delhi.

References

1. Reid, E. *Understanding Buildings*, MIT Press.
2. Olin, H.B. *Construction Principles, Methods and Materials*
3. Ching, F.D.K. *Building Construction Illustrated.*
4. Kumar, S. (2010). *Building Construction*, Standard Publishers Distributors, New Delhi.
5. Singh G. (2010). *Building Construction*, Standard Book House, New Delhi.

Pokhara University
Faculty of Science and Technology

Course Code: MTH 210	Full Marks: 100
Course title: Calculus II (3-2-0)	Pass Marks: 45
Nature of the Course: Theory	Total Lectures: 45 hours
Level: Bachelor	Program: BE

1. Course Description

The Calculus II is designed to develop the competency of the students in the applications of various mathematical concepts they learned in previous semesters. It is mainly equipped with Vector Calculus, Laplace transform, Multiple integrals, Differential Equations, Fourier Series and with introduction of Partial differential equations. The pre-requisite for this course is Calculus I and Algebra & Geometry. The course will be delivered through lecture method, assignments on practically based engineering problems and class tests.

2. General Objectives

The course is designed to acquaint the students with applications of mathematics in engineering.

3. Methods of Instruction

Lecture, tutorials, discussions and assignments

4. Contents in Detail

Specific objectives	Contents
Evaluate multiple integrals	**Unit I: Multiple Integrals (6 Hours)** 1.1 Introduction 1.2 Double integrals in Cartesian and polar form, Fubini's theorem (statement only), change of order of integration, change of variable from in double integral Jacobian matrix and reduction into Polar. 1.3 Triple integrals in Cartesian form and Dirichlet's Integral, use of cylindrical and spherical coordinates to evaluate triple integral. 1.4 Application of double and triple integrals to find Area and volume.
Analyze the concept of solution of differential equations in terms of infinite series as power series.	**Unit II: Series Solution of Differential Equations and Special Functions (6 Hours)** 2.1 Power series method of solution of differential equations. 2.2 Legendre's Equation, Legendre's polynomials $P_n(x)$ of . Graph of $P_1(x), P_2(x), P_3(x)$. 2.3 Frobenius method. Bessel's equation, Bessel's function $J_v(x)$ and its properties. Graph of $J_v(x)$ for $v=1\wedge 2$
Apply the integral transform in solving practical problems	**Unit III: Laplace Transform and Its Application (8 Hours)** 3.1 Laplace Transform (LT), Inverse LT, Linearity of LT, LT of elementary functions, inverses and first shifting (s-shifting) theorem. Existence theorem of Laplace transform (without proof) and uniqueness. 3.2 Transform of Derivative and Integrals of a function.

	3.3 Differentiation and Integration of Laplace transform. 3.4 Unit step function, periodic function and LT, second shifting (t-shifting) theorem. 3.5 Convolution theorem and its application to find inverse. 3.6 Application of Laplace transform to find the solutions of ordinary differential equations (IVP).
Solve higher dimensional (multivariable) calculus problems	**Unit IV: Advanced Vector Calculus (15 Hours)** 4.1 Differentiation of vector function of scalar variable. 4.2 Point functions, Gradient, directional derivative, divergence and curl with properties (without proof) 4.3 Line integral with physical interpretation and evaluation of line integrals on various path 4.4 Line integral, potential function and independence of path 4.5 Green's theorem in plane (without proof) and its various applications 4.6 Surface integral and evaluation of surface integrals 4.7 Stoke's theorem (without proof) and its applications 4.8 Gauss Divergence theorem (without proof) and its applications.
Illustrate periodic functions of practical importance by infinite trigonometric series	**Unit V: Fourier Series (5 Hours)** 5.1 Periodic Functions, odd and even functions 5.2 Fourier series of 2π periodic functions in the interval $(\alpha, \alpha+2\pi)$. 5.3 Fourier series of $2l$ periodic functions. 5.4 Fourier series of odd and even functions, sine and cosine series
Interpret physical phenomenon by partial differential equations	**Unit VII: Partial Differential Equations (5 Hours)** 7.1 Introduction 7.2 Linear constant coefficient equation 7.3 Applications in conservation laws, the breaking time, shock waves, nonlinear advection equations, and traffic flow.

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

5. List of Tutorials (30 hours)

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

Unit	Unit name	List of Tutorials	Tutorial hours
1	Unit I: Multiple Integrals	1.1 Problems on double integral by changing order of integration and reduction into polar. 1.2 Triple integral with examples on Dirichlet's integrals, use Cylindrical and Spherical coordinates. 1.3 Problems on area and volume by double and triple integral	2 hrs 1 hr 1 hr
2	Unit II: Series	2.1 Solve Legendre's polynomials $P_n(x)$ of different	2 hrs

	Solution of Differential Equations and Special Functions	order. 2.2 Solve Bessel's function $J_v(x)$ and their properties.	2 hrs
3	Unit III: Laplace Transform and Its Application	3.1Problems on Laplace and Inverse Laplace transform of different functions. 3.2 Solution of IVP using Laplace transform.	2 hrs 2 hrs
4	Unit IV: Advanced Vector Calculus	4.1 Problems on gradient, Normal vector to a surface, Directional derivative, angle between two surfaces. 4.2 Problems on divergence and curl. 4.3Problems on line integrals, Exactness and path independence. 4.4 Problems based on Green's theorem, Stoke's theorem and Gauss divergence theorem.	2 hrs 2 hrs 3 hrs 3 hrs
5	Unit V: Fourier Series	5.1 Problems on Fourier series in $(-\pi,\pi),(0,2\pi)\wedge\left(-\frac{\pi}{2},\frac{3\pi}{2}\right)$. 5.2 Problems on Fourier series of odd and even functions, Fourier series in general interval $(-l,l)$.	2 hrs 2 hrs
6	Unit VII: Partial Differential equation	6.1 Solve partial differential equations and their applications.	4 hrs

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

Pokhara University
Faculty of Science and Technology

Course Code: WRE 212	Full Marks: 100
Course title: Fluid Mechanics (3-2-1)	Pass Marks: 45
Nature of the Course: Theory & Practical	Total Lectures: 45 hours
Level: Bachelor	Program: BE

1. Course Description

The course aims to acquaint the students with concepts of Fluid Mechanics. It covers the fluid behaviors and principles of fluid mechanics for applications in Civil Engineering. It covers statics, kinematics, and dynamics of fluid. It equips students' ability to analyze momentum equation, use of boundary layer theorem and dimensional analysis.

2. General Objectives

The objective of this course is to provide concept and knowledge of Fluid Mechanics for the application in |Civil Engineering and Water Resources in particular.

3. Methods of Instruction

Lectures, discussions, tutorials, laboratory works and assignments

4. Contents in Detail

Specific Objectives	Contents
State the properties of fluids, pressure laws and its measurement	**Unit 1**: **Fundamentals of Fluids (6 hrs.)** 1.1 Definition, scope and application in civil engineering 1.2 Control volume and continuum concept 1.3 Fluid Properties: mass density, specific weight, specific gravity, cavitation, vapor pressure, surface tension, capillarity and viscosity 1.4 Types of fluid pressure, pressure head and laws of pressure 1.5 Measurement of Pressure: manometers (piezometer, U-tube manometer and micro manometers)
Determine the hydrostatic force on submerged objects, calculate equilibrium stability of floating objects, determine metacentric height, compute pressure force on dams and gates, determine the position of liquid in moving vessel	**Unit 2: Hydrostatic Forces on Submerged Surfaces (7 hrs.)** 2.1 Concept of hydrostatics on plane and curved surfaces 2.2 Total pressure and center of pressure (horizontal, vertical, inclined plane and curve surfaces) 2.3 Pressure diagram (horizontal, vertical and inclined plane and curve surfaces) 2.4 Computation of pressure forces on gates,

	dams, head water tank and other hydraulic structures (plane and curve)
State buoyancy and floatation concept, apply Archimedes principle, visualize equilibrium stability of submerged and floating bodies, determine metacentric height by analytical and experimental methods	**Unit 3: Equilibrium Stability (5 hrs.)** 3.1 Buoyancy and Archimedes principle, floatation concept 3.2 Condition of equilibrium: stability of submerged and floating bodies 3.3 Metacenter and determination of metacentric height (analytical and experimental method) 3.4 Liquid in relative equilibrium: liquid in a container subjected to uniform acceleration in horizontal, vertical and inclined directions; uniform radial acceleration about vertical axis
State Lagrangian and Eulerian concept in fluid flow, interpret flow patterns and types of fluid flow, Solve continuity equation through its application in measuring devices	**Unit 4**: **Fluid Kinematics** (**5hrs**.) 4.1 Lagrangian and Eulerian concept in fluid flow 4.2 Description of flow patterns: streamlines, streak lines, path lines, stream tube, stream functions and velocity potentials functions, basis of flow nets 4.3 Types of fluid flow: uniform and non-uniform; steady and unsteady; one-, two-, and three dimensional; laminar and turbulent; rotational and irrotational; compressible and incompressible 4.4 Conservation principle of mass; continuity equation in cartesian and polar co-ordinates 4.5 Flow through stream tube, discharges and mean velocity of flow
Identify forces acting on fluid in motion, Visualize Navier-Stokes' equation of motion, interpretation and use of Euler's equation, Apply Bernoulli's equation, Recall Momentum Principle and apply it	**Unit 5**: **Fluid Dynamics** (**4 hrs.)** 5.1 Various forces acting on fluid in motion (gravitational, pressure, viscous, turbulent, surface tension and compression) 5.2 Introduction to Navier-Stokes' equation of motion 5.3 Development of Euler's equation of motion and its application 5.4 Bernoulli's equation: derivation, assumptions, application examples 5.5 Momentum principle and equations (one and two-dimensional)
Identify Flow measurement devices; compute Flow through orifices, notches and	**Unit 6: Application of Energy and Momentum Equations (8hrs.)**

weirs; determine hydraulic coefficients; solve problems related to Force exerted by jets and Force exerted on pipe bends and closed conduits	6.1 Flow measurement devices: Venturi-meter (horizontal, inclined & vertical), Orifice meter, Nozzle meter and Pitot tube 6.2 Flow through orifices: small, large, partially and totally submerged 6.3 Hydraulic coefficients (C_v, C_c and C_d) and their determination 6.4 Flow over notches and weirs: Discharge equations, concept of end contraction and approach velocity 6.5 Force exerted by jets striking a flat plate, moving plane and curve vanes 6.6 Force exerted on pipe bends and closed conduits
Describe dimensional analysis and distinguish its methods, illustrate applications of dimensional analysis; apply Reynold's and Froude Model law in Civil Engineering	**Unit 7**: **Dimensional Analysis and Physical Modelling (5 hrs.)** 7.1 Introduction to dimensional analysis (physical quantity and their dimensions) 7.2 Methods of dimensional analysis: Rayleigh's method and Buckingham's π-theorem 7.3 Application of dimensional analysis 7.4 Concept of physical modelling and its relation to dimensional analysis 7.5 Laws of similarity 7.6 Model laws: Application of Reynold's and Froude Model law in Civil Engineering
Explain concept of boundary layer, describe laminar and turbulent boundary layer on a flat plate with zero pressure gradient; interpret drag and lift and its types, describe effect of pressure gradient and flow separation	**Unit 8**: **Flow Through Submerged Body and Boundary Layer Theory (5 hrs.)** 8.1 Description of boundary layer and its thickness 8.2 Laminar and turbulent boundary layer on a flat plate with zero pressure gradient 8.3 Friction drags for laminar and turbulent boundary layer 8.4 Effect of pressure gradient and flow separation 8.5 Concept of drag and lift, types and formulas 8.6 Drag on cylinder and flat plate 8.7 Application of boundary layer principle in Civil Engineering

5. List of Tutorials

The following tutorial activities of 30 hours per group of maximum 24 students should be conducted to cover all the required contents of this course.

S.N.	Tutorials	Hours
1	Determination of capillary rise/fall; surface tension; viscosity; shear stress and pressure measurement using piezometer and manometer	4 hrs
2	Calculation of total pressure force and Centre of pressure (horizontal, vertical, inclined, plane and curve surfaces) using formulas and pressure diagram Computation of pressure forces on gates, dams, head water tank and other hydraulic structures (plane and curve)	5 hrs
3	Determination of metacentric height, condition of stability of floating object, position of liquid in moving container, amount of spill	3 hrs
4	Verification of continuity equation, determination of components of velocities	3 hrs
5	Flow calculation using Bernoulli's equation in pipes	3 hrs
6	Determination of flow by using venturi-meter, orifice meter, calculation of hydraulic coefficient, determination of force using impulse-momentum equation, forces on pipe bends	5 hrs
7	Solving the problems related to dimensional analysis (Rayleigh's and Buckingham's π) Calculation of model/prototype dimensions using Reynold's and Froude Model law	4 hrs
8	Calculation of drag and lift forces	3 hrs

6. Practical Works

S.N.	Practical works
1	Newton's law of viscosity
2	Hydrostatic force on a submerged body
3	Stability of a floating body
4	Verification of Bernoulli's theorem
5	Impact of flow jet
6	Flow through edged orifice
7	Flow over broad-crested weir

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		
Attendance & Class Participation	10%			
Assignments	20%			
Presentations/Quizzes	10%			

Internal Assessment	60%		Semester-End examination	50
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. Modi, P.N. and Seth, S. M. *Fluid Mechanics and Hydraulics*
2. Rajput, R. K. *Fluid Mechanics and Hydraulic Machines*
3. Pritchard, Fox and McDonalds. *Introduction to Fluid Mechanics*

References:

1. John F. Douglas, Gasiorek, Swaffield, Jack., *Fluid Mechanics*
2. Bansal, R. K., *A Text book of Fluid Mechanics*
3. Jain, A.K., *Fluid Mechanics and Hydraulics*
4. Webster., *Fluid Mechanics*
5. Sangraula *D.P., Fundamentals of Fluid Mechanics*

Pokhara University
Faculty of Science and Technology

Course Code: MTH 252	Full Marks: 100
Course title: Numerical methods (2-1-2)	Pass Marks: 45
Nature of the Course: Theory and Practical	Total Lectures: 30 hours
Level: Bachelor	Program: BE

1. Course Description

This course explains how to utilize a computer to solve issues that calculus and algebra might not be able to. It fosters the development of mathematical relationships that can be utilized to model real-world situations and the problem-solving skills necessary to study other engineering courses.

2. General Objectives

The general objectives of this course is to equip students with knowledge and tools required to solve different equations that are applicable in the fields of engineering.

3. Methods of Instructions:

Lecture, Tutorial, Discussion, Readings and Practical works

4. Contents in Detail

Specific Objectives	Contents
Solve non-linear equations by different numerical methods.	Unit 1: **Solution of Non-linear equations (5 hrs)** 1.1. Introduction, Importance of Numerical Methods 1.2. Approximation and Errors in computation 1.3. Bisection Method 1.4. Secant method 1.5. Newton Raphson method 1.6. Fixed point iterative method
Visualize and solve mathematical relationships of practical observations.	Unit 2: **Interpolation and approximation (5hrs)** 2.1. Lagrange interpolation 2.2. Finite differences (forward, backward, and divided difference) 2.3. Newton's Interpolation (forward, backward) 2.4. Least square method of fitting linear and nonlinear curve for discrete data and continuous function 2.5. Cubic Spline Interpolation
Calculate definite integration and differentiation numerically.	Unit 3: **Numerical Differentiation and Integration (4 hours)** 3.1. Numerical Differentiation formulae 3.2. Trapezoidal, Simpson's 1/3, 3/8 rule 3.3. Romberg integration

	3.4. Gaussian integration (2- point and 3- point formula)
Solve the system of linear equations by different techniques.	Unit 4: **Solution of system of linear algebraic equations (6 hours)** 4.1. Gauss elimination method and concept of pivoting 4.2. Ill-conditioned system of linear equations 4. 3. LU Factorization method (Dolittle, Crout's, Cholesky's) 4.4. Iterative methods (Jacobi method, Gauss-Seidel method) 4.5. Eigen value and Eigen vector using Power method
Solve the ordinary differential equations which may exist in the field of engineering.	Unit 5: **Solution of ordinary differential equations (6 hours)** 5.1. Review of ordinary differential equations 5.2. Runge-Kutta methods (first, second and fourth) for first and second order differential equations 5.3. Solution of boundary value problem by shooting method
Solve numerically the partial differential equations which exist in the field of engineering.	Unit 6: **Numerical solution of Partial differential Equation (4 hours)** 6.1. Classification of partial differential equation (elliptic, parabolic and hyperbolic) 6.2. Solution of Laplace equation (standard 5-point formula with iterative methods) 6.3. Solution of Poisson equation (finite difference approximation method) 6.4. Solution of one-dimensional Heat equation by Schmidt method

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.	List of Tutorials	
1	Determination of a root by all methods and their comparison.	3 hrs
2	Finding of different interpolating polynomials, regression curve and Cubic-spline.	2 hrs
3	Determination of the first and second order derivatives by difference method and its comparison with exact value. Integration by Trapezoid, Simpson's rules, Romberg method,	2 hrs

	Gaussian method and comparison with exact value.	
4	Solution of system of linear equations by Gauss Elimination, matrix factorization, Jacobi, Gauss-seidel method Finding Eigen value and Eigen vector by power method.	4 hrs
5	Solution of first and second order differential equation by RK methods, and Shooting method.	2 hrs
6	Solution of Laplace, and Poisson's equations by five-point formula.	2 hrs

6. List of Practical

SN	List of Practicals
1.	Solution of nonlinear equations.
2.	Interpolation and regression.
3.	Differentiation and Integration.
4.	Linear system of equations and power method.
5.	Ordinary differential equations.

By using MATLAB/C/C++ or any other relevant high level programming languages.

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**	**Semester End**	**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				

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.

8. Prescribed Books and References

Text Books

1. C.F. Gerald and P.O. Wheatley *Applied Numerical Analysis (7th edition),* New york.
2. B. S. Grewal, *Numerical Methods in Engineering and Science* Khanna Publication, (10th edition)
3. S.S. Sastry *Introductory Methods of Numerical Analysis (4th edition),* Prentice-Hall of India, New Delhi, 2008.

References:

1. Richard L. Burden, J. Douglas Faires, "Numerical Analysis 7th edition", Thomson / Brooks/Cole
2. E. Balagurusamy *Numerical methods.* New Delhi; Tata McGraw Hill, 2010.
3. Dr. V. N. Vedamurthy & Dr. N. Ch. S. N. Iyengar *Numerical Methods,* Noida, Vikash Publication House 2009.
4. Rudra Pratap *Getting Started with MATLAB,* Oxford University Press 2010

Pokhara University
Faculty of Science and Technology

Course Code: STR 210	Full Marks: 100
Course title: Strength of Materials (3-2-1)	Pass Marks: 45
Nature of the Course: Theory and Practical	Total Lectures: 45 hours
Level: Bachelor	Program: BE

1. Course Description

This course is designed to develop the competency of the students in the material behavior, stress and strain in structural elements due to external loads and temperature changes.

2. General Objectives

The course is designed to provide fundamental concept on the geometrical properties of different figures, material behavior and strength required to design simple structural members.

3. Methods of Instruction

Lecture, tutorials, discussions and assignments

4. Contents in Detail

Specific Objectives	Contents
Identify the concept of statically determinate and indeterminate structure.	**Unit 1: Axial Forces, Shear Forces and Bending Moment (6 hrs)** 1.1 Introduction to strength of materials 1.2 Determinate and indeterminate structure 1.3 The concept of superposition of internal forces due to various combination of loads 1.4 Define axial force, shear force and bending moments and their relationships. 1.5 Draw axial forces, shear forces and bending moments in diagrams for statically determinate beam and frames.
Deduce principle moment of inertia and locate the principle axes of various geometry and their application in civil engineering.	**Unit 2: Geometrical Properties of Section (6 hrs)** 2.1 Review of center of gravity and Centroid, Radius of gyration and Moment of Inertia of built-up plane figures, Parallel axis Theorem 2.2 Polar Moment of Inertia 2.3 Product Moment of Inertia 2.4 Principle Moment and Principle axes of inertia for built-up plane figures and standard steel sections 2.5 Mohr's Circle for Principle Moment of Inertia
Discuss properties of elastic constant of a materials and its importance in Civil Engineering design. Calculate elongation and stresses developed in structural element due to different forces.	**Unit 3: Direct Stresses and Strains (8 hrs)** 3.1 Introduction of internal forces, stresses and strains 3.2 Stress strain diagrams for ductile and brittle materials 3.3 Normal stress-strain, shear stress-strain, Hooke's law, Poisson's ratio, modulus of elasticity, modulus of rigidity, volumetric strain, bulk modulus and their relationship. Multi-axial loading and generalized Hooke's Law

	3.4 Factor of safety and permissible stresses. 3.5 Saint-Venant's principle and stress concentration 3.5 Elongation of bars: Uniform/varying cross-sections, tapered section(circular and trapezoidal) due to external axial force 3.6 Compound bars subjected to axial force 3.7 Thermal stresses: single bar, compound / composite bars 3.8 Solving technique for axial indeterminate structure by using compatibility equations
Discuss the concept of principle stresses developed in inclined plane due to normal and shear stress	**Unit 4: Principal Stresses (5 hrs)** 4.1 Introduction 4.3 Stresses on an inclined plane subjected to two mutually perpendicular normal and shear stresses 4.4 Principal stresses and their positions 4.5 Mohr's circle diagram for principle Stresses
Explain the effect of bending stress, horizontal shear stress at any position of x-section and also to determine slope and deflection of beam	**Unit 5: Theory of Flexure (8 hrs)** 5.1 Introduction to flexure 5.2 General case of bending and pure bending, assumptions, elastic curve, radius of curvature, derivation of bending equation. 5.3 Bending stress variation, position of neutral axis, sectional modulus, flexural stiffness 5.4 Analysis of beams of symmetric cross-section 5.4 Analysis of composite beams 5.5 Shear stress variation in rectangular and symmetrical I - and T- sections 5.6 Concept of slope and deflection in beams, differential equations of deflected shapes, determination of maximum slope and deflection for beams subjected to point load and uniformly distributed load: simply supported beam and cantilever beam
State the strength of circular shaft and list the different types of composite shaft	**Unit 6: Torsion of Circular Shafts (3 hrs)** 6.1 Introduction 6.2 Assumptions and derivation of torsional equation 6.3 Shear stress variation and torsiosnal rigidity 6.4 Power transmitted by shaft 6.5 Shafts in series and parallel
Explain about the application of thin walled vessel in daily uses, able to calculate stresses developed due to pressure	**Unit 7: Thin- Walled Pressure Vessels (3 hrs)** 7.1 Introduction of thin walled Vessels 7.2 Types of stresses and strains in thin-walled cylindrical and spherical vessels 7.3. Calculation of stresses and strains in thin-walled vessels
Describe the concept of failure mechanism in different types of column and measure its strength	**Unit 8: Column Theory (3 hrs)** 8.1 Introduction to column and strut 8.2 Classification of column based on slenderness ratio 8.3 Assumption and derivation of Euler's Formula 8.4 Limitation of Euler's Formula 8.5 Intermediate columns; derivation of column-bucklings 8.6 Introduction to slender column

Explain the bending effect in structural member due to axial and bending moments also locate the position of axial load for no tension	**Unit 9: Compound Stresses Failure Theories (3 hrs)** 9.1 Introduction to different failure theories 9.2. Load acting eccentrically to one and both axes 9.3. Condition for no tension in the section

5. Laboratories

1. Tensile test and stress-stress curve for steel, aluminum, timber and compressive test in concrete
2. Axial and compressive stress determination
3. Center of gravity and Moment of Inertia of simple plane lamina
4. Simple bending test on beams
5. Torsion test on simple shaft
6. Test on column behavior and buckling

6. Tutorials (30 hrs.)

1. Determination of stability, determinacy and indeterminacy of structures
2. Derivation and numerical based problems on axial force, shear force and Bending moment for beams and frames
3. Derivation and numerical based problems on geometrical properties of 2-D and 3-D figures
4. Determination of stresses and strains on regular and irregular structural members due to external forces, self-weight and temperature change
5. Derivation and numerical based problems on principal stresses and strains
6. Derivation and numerical based problems on flexure and deformation of beams
7. Derivation and numerical based problems on circular shafts due to torsion
8. Derivation and numerical based problems on thin walled vessels
9. Derivation and numerical based problems on columns
10. Derivation and numerical based problems on compound stresses and failure theories

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
R. K. Rajput. *Strength of Materials (Mechanics of Solids), S. Chand, New Delhi*

References

1. *G.B. Motra. A text book of strength of materials, Heritage Publishers & Distributors Pvt. Ltd*
2. Timoshenko and Gere 'Mechanics of Materials",
3. Beer F.P. and E.R. Johnston "Mechanics of Materials and Structures
4. E. P. Popov. *Mechanics of Materials, 2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi,1989*
5. *S. S. Vavikatti. Strength of Materials, Vikas Publication, New Delhi*
6. *G. H. Ryder. Strength of Materials, 3rd Edition, Macmilliam, ELBS, 1985*
7. *R. K Bansal. A text book of strength of materials, Laxmi publication, New Delhi*
8. *S. P. Timoshenko & D. H. Young. Elements of Strength of Materials, 5th Edition, East-West Press Pvt. Ltd., 1987*

Pokhara University
Faculty of Science and Technology

Course Code: CVL 216	Full Marks: 100
Course Title: Surveying I (3-1-3)	Pass Marks: 45
Nature of the Course: Theory & Practical	Total Lectures: 45 hours
Level: Bachelor	Program: BE

1. Course Description

This course is designed to provide students with a comprehensive grounding in the principles, tools, and applications of surveying. Major content areas covered include the fundamentals of surveying, compass survey techniques, leveling methods, and understanding of advanced surveying instruments such as EDM, Theodolite, and Total Station, as well as intricate topics like tacheometry, contouring, trilateration, and triangulation. The curriculum is structured in distinct units, each diving deep into specific surveying facets, allowing students to sequentially build their expertise. Additionally, the "Instruction on Field Works" sections in multiple units signify the course's emphasis on practical application, ensuring students not only understand theoretical concepts but can also implement them in real-world scenarios.

2. General Objectives

The course is designed to apply civil engineering students with comprehensive knowledge and practical skills in surveying methodologies, instruments, and applications essential for accurate land and terrain assessments.

3. Methods of Instruction

Lectures, Tutorials, Discussion, Readings and Practical works

4. Contents in Detail

Specific Objectives	Contents
State and interpret the fundamentals of surveying principles, tools, and practices.	**Unit I: Introduction to Surveying (4 hrs)** 1.1 Definition of Surveying 1.2 Plane and Geodetic Surveying 1.3 Classification of Surveying- Based on the nature of survey, objective of survey, and the instrument used 1.4 Instruments and Tools Used in Surveying- Their Purposes 1.5 Principles of Surveying 1.6 Scales, Maps, and Plans 1.7 Units of Measurement (Length, Area, and Volume) and Conversions 1.8 Accuracy and Error
Apply and analyze compass usage and its significance in the surveying field.	**Unit II: Compass Survey (5 hrs)** 2.1 Introduction, Uses and Importance 2.2 Meridians, Bearings and Angles 2.3 Designation of Bearings, Whole circle and Quadrantal system and Conversions 2.4 Fore Bearing and Back Bearing 2.5 Types of Compass

	2.6 Magnetic Declination 2.7 Local Attraction 2.8 Closing Error and Adjustments (Graphical and Analytical) 2.9 Instruction on Field Works
Apply and analyze the principles and techniques of levelling.	**Unit III: Levelling (10 hrs)** 3.1 Levelling- Basic Definitions and Importance 3.2 Types of Levelling- Spirit, Trigonometrical and Barometric 3.3 Spirit Levelling- Basic Definitions and Types 3.4 Methods of Reducing Levels and their Booking – HI and Rise & Fall Method, Arithmetic Checks 3.5 Two peg test 3.6 Effect of Curvature and Refraction 3.7 Reciprocal Levelling 3.8 Permissible Error in Levelling 3.9 Sources of Error in Levelling 3.10 Trigonometrical Levelling- Problems of Height and Distances 3.11 Practical Cases in Levelling 3.12 Instruction on Field Works
Visualize with advanced surveying instruments and their applications.	**Unit IV: Introduction to EDM, Theodolite and Total Station (4 hrs)** 4.1 Principle of Electronic Distance Measurement and Use of EDM 4.2 Types of Theodolite and its components 4.3 Principle of Theodolite 4.4 Uses of Theodolite- Measurement of Horizontal & Vertical Angles and Bearings 4.5 Components of Total Station 4.6 Electronic Data Recording 4.7 Uses of Total Station
Apply and analyze traverse techniques, compute coordinates, rectify errors, address omitted measurements, and plot traverses.	**Unit V: Theodolite Traversing (10 hrs)** 5.1 Traverse- Definition, Types and Uses 5.2 Checks in Closed and Open Traverse 5.3 Consecutive and Independent Co-ordinates; and its Computation 5.4 Closing Error in Closed Traverse, its Computation and Balancing 5.5 Degree of Accuracy in Traversing 5.6 Plotting of Theodolite Traverse 5.7 Omitted Measurements 5.8 Instruction on Field Works
Apply and analyze various tacheometric systems	**Unit VI: Tacheometry (5 hrs)** 6.1 Introduction, Uses and Importance 6.2 Principles of Optical Distance Measurement 6.3 Systems of Tacheometry-Stadia System and Tangential System 6.4 Distance Measurement using Vertical Staff

	6.5 Instruction on Field Works
Interpret how terrain variations are represented through contours	**Unit VII: Contouring (4 hrs)** 7.1 Basic Definitions in Contouring 7.2 Contour Interval 7.3 Characteristics of Contours 7.4 Methods of Contouring 7.5 Interpolation of Contours 7.6 Uses of Contour Maps 7.7 Instruction on Field Works
Apply and analyze trilateration and triangulation systems.	**Unit VIII: Trilateration and Triangulation (3 hrs)** 8.1 Principles of Trilateration 8.2 Principles and Classification of Triangulation Systems 8.3 Strength of Figure 8.4 Satellite Stations and Inter-Visibility of Triangulation Stations 8.5 Instruction on Field Works

5. List of Tutorials

The following tutorial activities should be conducted to cover all the required contents of this course.

S.N.	Tutorials
1	Solving the problems related to the units of measurement and their conversions.
2	Determination of bearings, bearings conversions, Local attraction and closing error computation and adjustments in compass surveying.
3	Determination of the reduced level of any station using different methods of levelling.
4	Computation of consecutive and independent coordinates in closed and open traverse, balancing of closing error and determining omitted measurements.
5	Solving the problems related to the tacheometery.
6	Determination of Index contour and contour plotting.

6. Practical Works

S.N.	Practical works
1	Horizontal, Vertical, and Sloping Distance Measurement – use of tapes, Abney level, and ranging rods.
2	Two Peg Test and Transfer of RL from BM to a point by Fly Levelling or Differential Levelling.
3	Preparation of L-section and X-section of a road alignment.
4	Demonstration of Theodolite and Total Station and traverse survey using theodolite or Total Station.
5	Preparation of detailed topographic map by traversing using theodolite or Total station, with distances and elevations computed by tacheometry and contours drawn after arithmetic interpolation.
6	Determination of elevation of accessible and inaccessible points by Trigonometrical Levelling.
7	EDM Demo

8	Measurement of a plot of Land by trilateration and computation of area in various systems (Ropani, Bigha, Hectare etc.)

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 a 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 Textbooks and References

Text Books

1. Punima, B.C., Jain Ahok K. & Jain, Arun K. *Surveying Vol I, II, III.* New Delhi: Laxmi Publications. 2005.
2. Agor, R. A text book of Surveying and levelling. Khanna Publishers

References

1. Clark, D. *Plane and Geodetic Surveying for Engineers Vol. I, II.* Michigan: Constable Limited. 1923.
2. Bannister, A., Raymod, S. & Baker, Raymond. *Surveying* (7the edition). New Delhi: Pearson education.
3. Kanetkar, T.P. *Surveying.*
4. Basak, N.N. *Surveying and Levelling*. New Delhi: Tata McGraw Hill.