MTH 114 Engineering Mathematics II (3 – 2 – 0)

Evaluation:

	Theory	Practical	Total
Sessional	50	-	50
Final	50	-	50
Total	100	-	100

Course Objectives:

The main objective of this course is to provide the basic knowledge of three-dimensional geometry, Calculus of several variables, differential equation, Laplace transform. After the completion of this course, students can use their knowledge in their professional course.

Course Contents:

1. **Three-Dimensional Geometry** **12 hrs**
   - 1.1 Review of direction cosines, direction ratios, Planes
   - 1.2 Straight lines
   - 1.3 Sphere and its tangent plane
   - 1.4 Cone and cylinder (definitions, standard equation only)

2. **Partial Derivatives and Extreme Values for Functions of two or more Variables** **6 hrs**
   - 2.1 Definitions, total derivatives, Chain rule, Euler's theorem for function of two or three variables, its application
   - 2.2 Extreme values for two or more variables

3. **Laplace Transformation** **8 hrs**
   - 3.1 Definition
   - 3.2 Derivation of formulae
   - 3.3 Application of Laplace transform
   - 3.4 Inverse Laplace transform
   - 3.5 Convolution theorem on Laplace transform and application

4. **Differential Equations** **13 hrs**
   - 4.1 Order and degree of differential equation
   - 4.2 First order differential equation with their solutions (separable, reducible to separable form exact ness condition), linear and Bernoulli's equation
   - 4.3 Second order differential equation (Homogeneous and non-homogeneous) with constant coefficient as well as variable coefficients.
   - 4.4 Initial value problem.
   - 4.5 Power Series solution
   - 4.6 Legendre's and Bessel equation with their solution, properties and application

5. **Double Integral** **6 hrs**
   - 5.1 Definitions, Fubinis theorems (statement only)

5.2 Change of order,
5.3 Change Cartesian integral to equivalent polar integral
5.4 Area and volume by double integral

Text Books:

1. Engineering Mathematics II: Prof. D.D Sharma (Regmi), Toya Narayan Paudel, Ha Prasad Adhikari, Sukunda publication, Bhotahity, Kathmandu.
2. Advance Engineering Mathematics: Erwin Kreyszig.

References:

1. Calculus with analytical geometry: E.W. Swokoswski.
2. Algebra: G.D Pant
3. Three-Dimensional Geometry: Y.R Sthapit, B.C Bajracharya
4. Calculus and analytical geometry: George B Thomas, Ross L. Finney

CHM 111 Chemistry (4 – 1 – 2)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

1. Analyze chemical behavior of materials
2. Analyze the water quality.
3. Analyze environmental aspects of various elements and compounds.

Course Contents:

1. **Ionic Equilibria and Electro Chemistry** **10 hrs**
Introduction and types of buffer solutions, mechanism, Henderson- Hassel Balch equation, electro chemical cells, Galvanic cell, cell notation, cell reaction, cell potential, single electrode potential, standard electrode potential, electro chemical series & its applications, Nernst equation, corrosion, its type, mechanism and control.

2. **General Inorganic Chemistry** **10 hrs**
Ionization energy, electro negativity, electron affinity, characteristic properties of S and P block elements, introduction of Transition metals, characteristic properties of transition metals (electronic configuration, atomic radii, variable oxidation states, complex formation, color and magnetic properties

3. **General Organic Chemistry** **10 hrs**
Reaction intermediates: carbocations, carbanions and carbon free radicals, stereoisomerism
Organic reaction mechanism: Nucleophilic substitution reactions (SN1&SN2), Electrophilic aromatic substitution, Elimination (E1 & E2), Electrophilic and free radical addition reaction

4. **Polymer Chemistry** **10 hrs**
Polymer and polymerization, basic concepts, types of polymerization (addition and condensation), thermoplastics and thermosetting plastics, preparation, properties and uses of: polyethylene, PVC, Teflon, Bakelite's, Nylon, polyester, polyurethelene and silicon, rubber, processing of natural rubber and vulcanization

5. **Analytical Chemistry** **6 hrs**
Introduction and application of following analytical techniques: fractional distillation, chromatography (paper, thin layer) NRM, Mass spectroscopy

6. **Industrial Chemistry** **4 hrs**
Introduction of paints, chemistry of paints, lubricants and its classification, cement, chemistry of cement, manufacture & its setting mechanism, Explosives: TNT, TNG

7. **Environmental Chemistry**

Water pollution- causes of water pollution, acid rain, alkalinity COD, DO, Hardness (effects on human health), control

Air pollution: causes, global warming and climate change ozone layer depletion and control measures

Soil pollution: causes, effects and its control measures

Laboratory works

Objectives

- Use techniques apparatus and instructions properly
- Interpret, evaluate and report upon observations and experimental results
- Design/plan on investigation, select techniques, apparatus and materials
- Evaluate methods and suggest possible improvements

Laboratory works

1. Determine of total alkalinity of given water sample
2. Determination of hardness of water sample by complexometric titration
3. Determination of free chorine in the given water sample
4. Preparation of buffer and determination of pH of the solution
5. Estimation of DO in the given water sample
6. Estuation of COD in the given water sample
7. To separate the ink mixture by paper chromatography or TLC (Demo)
8. To purify a sample of mixture of crude alcohol and petroleum by fractional distillation (Demo)
9. To estimate carbon monoxide gas in the car exhaust (Demo)

Text Books:

1. Physical Chemistry, B.S. Bahl and G.D. Tuli
2. Advanced inorganic Chemistry, J. D. Lee
3. Advance Organic Chemistry, Morisson and Boyd 6th edition
4. Engineering Chemistry (with experiments), Sunita Rattan, 4th edition Publisher Engineering and Computer books

References:

1. Polymer Science, V.R. Gowariker, N. V. Vishwanathan
2. Environmental Chemistry, Anil Kumar Datta
3. Advanced Organic Chemistry, A. Bahl and B. S. Bahl
4. Text book of Chemistry P.N. Chaudhary and M.L. Bhusal
5. Lab manual of Engineering Chemistry by S.K. Bhasin and Sudha Rani

CMP 115 Object Oriented Programming in C++ (3 – 1 – 3)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

- To familiarize with Object Oriented Concept.
- To introduce the fundamentals of C++
- To enable the students to solve the problems in Object Oriented technique
- To cope with features of Object Oriented Programming

Course Contents:

1. **Thinking Object Oriented** **4 hrs**
   Object oriented programming a new paradigm, a way of viewing world agent, types of classes, computation as simulation, coping with complexity, nonlinear behavior of complexity, abstraction mechanism

2. **Classes and Methods** **7 hrs**
   Review of structures, classes and inheritance, state, behavior, method, responsibility, encapsulation, data hiding, Functions: friend function, inline function, static function, reference variable, default argument

3. **Message, Instance and Initialization** **6 hrs**
   Message, message passing formalization, message passing syntax in C++, mechanism for creation and initialization (constructor and its types), Issues in creation and initialization: memory map, memory allocation methods and memory recovery

4. **Object Inheritance and Reusability** **9 hrs**
   Introduction to inheritance, Subclass, Subtype, Principle of Substitutability; Forms of polymorphism and their implementation in C++, inheritance merits and demerits, composition and its implementation in c++, The *is-a* rule and has-*a* rule, Composition and Inheritance contrasted, Software reusability

5. **Polymorphism** **8 hrs**
   Polymorphism in programming language, Varieties of polymorphism, compile time polymorphism, function overloading, operator overloading, type conversion, polymorphic variable, run time polymorphism, object pointer, this pointer, virtual function, overriding, deferred method, pure polymorphism

6. **Template and generic programming** **4 hrs**
   Generic and template functions and classes, cases [illegible] container class and the standard template library, Exception handling

7. **Object oriented Design**

Reusability implies non- interference, Programming in small and programming in la components and behaviors, role of behaviors in OOP, CRC, sequence diagram, Softw components, formalizing the interface, interface and implementation, Design representation of components, coming up with names, implementation compone integration of components

Laboratory Work

There shall be 20 exercises in minimum, as decided by the faculty. The exercises shall encompas a broad spectrum of real-life and scientific problems, development of small program to th development of fairly complex subroutines, programs for engineering applications and problem solving situations. Laboratory assignments will be offered in groups of two to four for evaluatio purpose. In general, the Laboratory Work must cover assignments and exercises from th following areas:

1. Data types – control structures, functions and scoping rules.
2. Composite data types, C++ strings, use of "Constant" keyword, pointers and references
3. Classes and data abstraction
4. Inheritance, abstract classes and multiple inheritance
5. Friend functions, friend classes and operator overloading.
6. Static class members
7. Polymorphism, early binding and late binding
8. C++ type conversion
9. Exception handling
10. Function templates, class templates and container classes.

Text Books:

1. Budd, T., *An Introduction to Object Oriented Programming*, Second Edition, Addison Wesley, Pearson Education Asia, ISBN: 81-7808-228-4.
2. R. Lafore, *Object Oriented Programming in Turbo C++*, Galgotia Publications Ltd. India 1999

References:

1. E Balaguruswamy, Object Oriented Programming with C++, Third Edition
2. Tata McGraw-Hill ISBN:0-07-059362-0, Parson David, Object Oriented Programming with C++, BPB Publication\ISBN817029-447-9

ENG 111 Communication Technique (2 – 2 – 1)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

The main objectives of this course are:

4. To develop the ability to deliver technical knowledge orally in English.
5. To be able to comprehend and take notes after listening.
6. To fasten reading skills in technical and non-technical reading materials.
7. To develop summarizing skills in writings.
8. To write reports, letters, description on technical talks, seminar papers, memoranda, application

Course Contents:

1. **Review of Written English** **2 hrs**
   - Identification of Sentence and clause
   - Classification of sentence (simple, compound, complex)
   - Transformation of sentences

2. **Oral Communication and Note Taking** **9 hrs**
   - Variety of English (BrE, AmE, formal, informal, polite, familiar, tentative)
   - General rules of pronunciation (English Vowels and Consonants)
   - General rules of stress and intonations
   - Oral presentation/technical talk: Environmental pollution, construction, water resources, impact of satellite communication, urban development, impact of computer in modern society

3. **Technical Writing Skills** **10 hrs**
   - Preparation of short memoranda (Importance, formats)
   - Business letters (Importance-purposes)
   - Preparation of job application and CV
   - Description writing (Process, Mechanism, Place etc.)
   - Calling meeting and writing minutes, notification, preparation of agenda

4. **Reading Skills** **9 hrs**
   - Comprehension questions and exercises from:
   - The use and the misuse of science, Road foundation, Beauty, Custom, The story of an hour (Kate Chopin), Knowledge and wisdom, Freedom, Letter from foreign grave (D. B Gurung), Natural Resources of Nepal: Forests & Water (Mani Bhadra Gautam)
   - Note making and precise writing from any passage

Tutorial Works:

1. Some general rules of pronunciation
2. To present a seminar paper/report/proposal.
3. To participate in a group discussion.
4. To conduct a meeting.
5. To prepare and practice to face an interview.

Text Books:

4. Andrea J. Rutherford. *Basic Communication Skills for Technology*. 2nd Edition. Addisio Wesley. Pearson Education Asia (LPE) ISBN: 8178082810
5. Khanal Arjun, Communication Skills in English, Sukunda Pustak Bhawan, 2010

References:

4. Anne Eisenberg, *Effective Technical Communication*, Mc-Graw Hill 1982.
5. V.R. Narayanaswami, *Strengthen your writing*, Orient Longman, Madras.
6. Champa Tickoo & Jaya Sasikumar, *Writing with a Purpose*, Oxford University Pr Bombay.
7. A handbook of pronunciation of English words (with 90-minute audio casset Communication Skills in English.
8. Chopin, Kate. "The Story of an Hour", Creative *Delights*
9. *Gautam Shreedhar, Creation & Criticism: A Miscellaneous Thought*
10. *Gautam Mani Bhadra, Essays, Stories, Passages, Paragraphs and Letter writing for Young Learners, Nirantar Prakashan, Kathmandu, 2008*

MEC 110 Mechanical Workshop (0 – 0 – 3)

Evaluation:

	Theory	Practical	Total
Sessional	-	100	100
Final	-	-	-
Total	-	100	100

Course Objectives:
To provide instructions and practical experience in basic mechanical workshop methods

Course Contents:

1. **Mechanical Workshop Materials** **4 hrs**
   Introduction to mechanical workshop, Basics of steel and cutting materials, Common non-ferrous metals, Important mechanical properties

2. **Measurement and Measuring Equipment** **1.5 hrs**

3. **Bench Tools and Basic Hand Operations** **1.5 hrs**
   Filing, Sawing, Sheet metal working, screw thread and screw thread cutting

4. **Joining Processes** **1.5 hrs**
   Riveting, Soldering, Brazing, Welding

5. **Introduction to Machine Tools** **1.5 hrs**
   Elements of machine tools, Cutting actions and tooling

6. **Familiarization with Basic Machine Tools** **5 hrs**
   Lathe, Milling machine, Drill presses, Power saws, Shaping Machine and Grinding machines

Practical:

6. To convert a metallic job piece into a prescribed form using mechanical bench tool.
7. To turn a cylindrical job piece to prescribed dimension by using lathe machine.
8. To convert a metallic job piece to prescribed dimension by using milling machine.
9. To provide surface finish to a metallic piece by using the shaper machine.
10. To weld required metallic pieces together by using electric arc and gas welding, to given shape and size.
11. To make knot & bolt of given size and type
12. To make tray/dust bin/ pen holder or similar item with sheet metal.

References:

11. Anderson and E.E. Tatro, *Shop Theory*, McGraw-Hill 5th edition, 1942.
12. Lascoe, C.A. Nelson and H.W. Porter, *Machine Shop Operation and Setups*, American Technical Society, 1973.

13. *Machine Shop Practice – Volume II*, Industrial Press, New York, 1971.
14. Oswald, *Technology for Machine Tools*, McGraw-Hill Ryerson, 3rd edition.
15. Oberg, Jones and Gorton, *Machinery's Handbook*, 23rd edition, Industrial Press, New Yo

MEC 130 Applied Mechanics I (3 – 2 – 0)

Evaluation:

	Theory	Practical	Total
Sessional	50	-	50
Final	50	-	50
Total	100	-	100

Course Objectives:

This course has been developed to provide the basic knowledge of engineering mechanics to the students of engineering so that it would be beneficial to understand structural engineering. The knowledge of mechanics can be utilized in wide range of engineering applications using Newton's laws of motion and mechanical equilibrium of different force system. This course shall be considered as a basic for all branches of Engineering of Pokhara University in first year of undergraduate program.

Course Contents:

2 hrs

1. **Introduction**
   - 1.1 Definition and scope of Applied Mechanics
   - 1.2 Concept of Statics and Dynamics
   - 1.3 Concept of Particle
   - 1.4 Concept of Rigid, Deformed and Fluid Bodies
   - 1.5 Fundamental Concepts and Principles of Mechanics: Newtonian Mechanics
   - 1.6 System of Units

2 hrs

2 **Review of Coordinate System**
   - 2.1 Cartesian Coordinate System
   - 2.2 Polar Coordinate System
   - 2.3 Cylindrical Coordinate System
   - 2.4 Spherical Coordinate System
   - 2.5 Review of Vector Algebra

7 hrs

3. **Forces Acting on Particles and Rigid Body**
   - 3.1 Types of Forces: Point Force, Transitional and Rotational Force- Relevant Examples
   - 3.2 Resolution and Composition of Forces- Relevant Examples
   - 3.3 Principle of Transmissibility and Equivalent Forces- Relevant Examples
   - 3.4 Moments: Moment of a Force about a point and an axis- Relevant Examples
   - 3.5 Theory of Couples: Relevant Examples
   - 3.6 Resolution of a Force into Forces and a Couple- Relevant Examples
   - 3.7 Resultant of Force and Moment for a System of Force: Examples

2 hrs

4. **Basic Concept of Static Equilibrium**
   - 4.1 Concept of Load types, Load Estimation and Support Idealizations- Examples and Standard Symbols
   - 4.2 Free Body Diagram- Relevant Examples

4.3 Physical Meaning of Equilibrium and its essence in structural application
4.4 Equation of Equilibrium in Two/Three Dimensions

5. Friction Forces 3 h
5.1 Introduction
5.2 Types of Friction and its Coefficients: Static and Dynamic
5.3 Laws of Friction
5.4 Angle of Friction
5.5 Engineering Examples of usage of Friction

6. Center of Gravity, Centroid and Moment of Inertia 6 h
6.1 Concept and Calculation of Centre of Gravity and Centroid of Line/Area /Volume Examples
6.2 Concept and Calculation of Second Moment of Area/ Moment of Inertia and Radius Gyration- Relevant Examples
6.3 Use of Parallel Axis Theorem: Relevant Examples

7. Analysis of Beam 5 h
7.1 Introduction Beam
7.2 Use of statically determinant beam
7.3 Relationship between Load, Shearing Force and Bending Moment
7.4 Calculation and drawing of Axial Force, Shear Force and Bending Moment

8. Analysis of Truss 4 h
8.1 Introduction to determinant truss
8.2 Use of truss in engineering application
8.3 Analysis of force by method of joint
8.4 Analysis of force by method of section

9. Kinematics of Particles and Rigid Body 6 h
9.1 Rectilinear Kinematics: Continuous Motion
9.2 Position, Velocity and Acceleration of a Particle and Rigid body
9.3 Determination of Motion of Particle and Rigid body
9.4 Uniform Rectilinear Motion of a Particles
9.5 Uniformly Accelerated Rectilinear Motions of Particles
9.6 Curvilinear Motion of a Particle
9.7 Rectangular Components of velocity and Acceleration
9.8 Introduction of Tangential and Normal Components
9.9 Radial and Transverse Components

10. Kinetics of Particles and Rigid Body: Force and Acceleration 6 h
10.1 Newton's Second Law of Motion and Momentum
10.2 Equation of Motion and Dynamic Equilibrium: Relevant Examples
10.3 Angular Momentum: Rate of Change and Conservation
10.4 Motion of Various Particles and Relative Velocity
10.5 Equation of Motion- Rectilinear and Curvilinear

10.6 Rectangular Components: Tangential and Normal
10.7 Polar Coordinates: Radial and Transverse Components

11. Moment and Energy in Rigid Body **2 hrs**

11.1 Introduction to Moment and Energy
11.2 Conservation of Linear and Angular Momentum

Text Books:

1. "Engineering Mechanics-Statics and Dynamics", Shames, I. H. 3rd ed., New Delhi, Prentice Hall of India, 1990.
2. "Mechanics of Engineers-Statics and Dynamics", F. P. Beer and E. R. Johnston, Jr. 4th Edition, Mc Graw-Hill Book Co., New York, USA (Asia Editions), 1987.

References:

1. "Engineering Mechanics-Statics and Dynamics", R. C. Hibbeler, Ashok Gupta, 11th edition. New Delhi, Pearson, 2009.
2. "Engineering Mechanics- Statics and Dynamics", I. C. Jong and B.G. Rogers.
3. "Engineering Mechanics- Statics and Dynamics", D.K. Anand and P.F. Connif.
4. "Engineering Mechanics of Solids", Egor P. Popov, 2nd Edition, New Delhi, Prentice Hall of India, 1996.
5. "Engineering Mechanics- Statics & Dynamics", Dr. D.S. Kumar, S. K. Kataria & Sons, New Delhi, Reprint 2011.
6. Practice guide in Applied Mechanics, D. B. Pandit, Ramesh Khanal