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 and 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**

i) Review of direction cosines, direction ratios, Planes
ii) Straight lines
iii) Sphere and its tangent plane
iv) Cone and cylinder (definitions, standard equation only)

2 Partial derivatives and Extreme values for function of two or more variables **6 hrs**

i) Definitions, total derivatives, Chain rule, Eulers theorem for function of two or three variables, its application
ii) Extreme values for two or more variables

3 Laplace transformation **8 hrs**

i) Definition
ii) Derivation of formulae
iii) Application of Laplace transform,
iv) Inverse Laplace transform
v) Convolution theorem on Laplace transform and application

4 Differential equation **13 hrs**

i) Order and degree of differential equation
ii) First order differential equation with their solutions (separable, reducible to separable form exact ness condition), linear and Bernoulli's equation)
iii) Second order differential equation (Homogeneous and non homogeneous) with constant coefficient as well as variable coefficients.
iv) Initial value problem.
v) Power Series solution
vi) Legendres and Bessel equation with their solution, properties and application

5. **Double Integral** **6 hrs**
   i) Definitions, Fubinis theorems (statement only)
   ii) Change of order,
   iii) Change Cartesian integral to equivalent polar integral
   iv) 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.

Reference Books:

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

MEC 20 Engineering Drawing (0-0-6)

Evaluation:

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

Course Objectives:

The objective of this course is to develop the basic concepts on the projection of points, lines, planes and geometric solids. This course will impart the skills of drafting and sketching to facilitate communication. After the completion of this course students will be able to draw assembly of machine drawing.

Course Contents:

1. **Instrumental Drawing, Practices and Techniques** **(12 hrs)**

Equipment and meterials, Description of drawing instruments, auxiliary equipment and drawing materials, Techniques of instrument drawing, pencil sharpening, securing paper, proper use of T-squares, triangles, scales, dividers, compasses, erasing shields, French curves, inking pens.

Freehand Technical Lettering

Lettering strokes, letter proportions, use of pencils and pens, uniformity and appearance of letters, freehand techniques, inclined and vertical letters and numerals, upper and lower cases, Standard English lettering forms.

Dimensioning

Fundamentals and Techniques: size and location dimensioning, IS conversion; Use of scales, measurement units, reducing and enlarging drawings; General dimensioning practices: placement of dimensions aligned and unidirectional recommended practice some 50 items.

2. **Applied Geometry**

Plane geometrical construction: Bisecting and trisecting lines and angles, proportiona **(24 hr** division of lines, construction of angles, triangles, squares, polygons, construction using tangents and circular archs. Methods of drawing standard curves such as ellipse parabolas, hyperbolas, involutes, spirals, cycloid and helices (cylindrical and helical) Solid geometrical construction: Classification and pictorial representation of solic regular objects such as: prisms, square, cubical, triangular and oblique, Cylinders: righ and oblique, Cones: right and oblique, Pyramids: square, triangular, oblique, truncated Doubly-curved and warped surfaces: Sphere, torus, oblate ellipsoid, conoid, serpentine paraboloid, hyperboloid

Basic Descriptive Geometry

Introduction: Application of descriptive geometry principles to the solution of problems involving positioning of objects in three-dimensional space; The projection of points, and planes in space; Parallel lines; True length of lines: horizontal, inclined and oblique lines; Perpendicular lines; Bearing of a line; Point view of end view of a line; Shortest distance from a point to a line; Principal lines of a plane; Edge view of a plane; True shape of an oblique plane;

Intersection of a line and plane; Angle between a line and a plane; Angle between two non-intersecting (skew) lines; Dihedral angle between two planes; Shortest distance between two skew lines.

3. Theory of Projection Drawing (24 hrs)

Perspective projection drawing; Orthographic projection; Axonometric projection; Oblique projection; First and third angle projection;

Multi-view Drawings

Principal views: Methods for obtaining orthographic views: Projection of lines, angles and plane surfaces, analysis in three views; Projection of curved lines and surfaces; Object orientation and selection of views for best representation; Full and hidden lines. Orthographic drawings: Making an orthographic drawing, Visualizing objects from the given views; Interpolation of adjacent areas; True-length lines; Representation of holes; conventional practices.

Sectional views

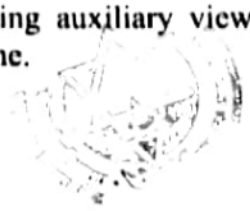
Full section view; Half section; Broken section; Revolved section; Removed (detail) sections; Phantom of hidden section; Auxiliary sectional views; Specifying cutting planes for sections; conventions for hidden lines, holes, ribs, spokes.

Auxiliary Views

Basic concept and use of auxiliary views; Drawing methods and types of auxiliary views; Symmetrical and unilateral auxiliary views; Projection of curved lines and boundaries; Line of intersection between two planes; True size of dihedral angles; True size and shape of plane surfaces.

4. Development and Intersections (15 hrs)

Development: General concepts and practical considerations, Development of a right or oblique prism, cylinder, pyramid and cone; Development of truncated pyramid and cone; Triangulation method for approximately developed surfaces; Transition pieces for connecting different shapes; Development of a sphere; Intersections: Lines of intersection of geometric surfaces; Piercing point of a line and a geometric solid; intersection lines of two planes; Intersection of prisms and pyramids; Intersection of a cylinder and an oblique plane; Intersection of a sphere and an oblique plane; Constructing a development using auxiliary views; Intersection of two cylinders; Intersection of a cylinder and cone.



(15 hr.

Machine Drawing

Introduction: production of complete design and assembly drawings; Fundamental techniques: size and location dimensioning; placement of dimension lines and general procedures; standard dimensioning practice (IS system); Limit dimensioning: nominal and basic size, allowance, tolerance, limits of size, clearance fit, interference fit; basic hole system and shaft systems; Thread and standard machine assembly elements: screw threads: ISO standards, representation and dimensioning; Fasteners: type and drawing representation, keys, collars, joints, springs bearings; Assembly drawings: drawing layout, bill of materials, drawing layout, bill of materials, drawing numbers.

Laboratory Work:

Freehand technical lettering and use of drawing instruments; Dimensioning; Geometrical and Projection drawing; Descriptive geometry; Projection and multiview drawings; Sectional views; Auxiliary views; Freehand sketching and visualization; Development and intersections; machine and assembly drawings.

Reference Books:

1. Luzadder, *Fundamentals of Engineering Drawing*, Prentice Hall of India Ltd., 8th edition, 1981.
2. French, C.J. Vierck and R.J. Foster, *Engineering Drawing and Graphic Technology*, McGraw-Hill, 1981.
3. Machine drawing P.S. Gill, S.K. Kataria and Sons, India, 7th Edition, 2008.

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:

The objective this course is to familiarize with Object Oriented Concept, to introduce the fundamentals of C++, to enable the students to solve the problems in Object Oriented technique and 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 study: container class and the standard template library, Exception handling

7 **Object oriented Design**
Reusability implies non- interference, Programming in small and programming in large, components and behaviors, role of behaviors in OOP, CRC, sequence diagram, Software components, formalizing the interface, interface and implementation, Design and representation of components, coming up with names, implementation components, integration of components

Laboratory Work

There shall be 20 exercises in minimum, as decided by the faculty. The exercises shall encompass a broad spectrum of real-life and scientific problems, development of small program to the 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 evaluation purpose. In general, the Laboratory Work must cover assignments and exercises from the 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

Reference Books:

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

MTH 130 Mathematical Foundation of Computer Science (3-1-0)

Evaluation:

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

Course Objectives:

1. The main objective of this course is to build up the mathematical foundation for the study of computational science and computer technology.
2. This course introduces the student to discrete mathematics and finite state automata through an algorithmic approach and focuses on various problems solving technique.
3. It helps the target student in gaining fundamental and conceptual clarity in the area of Logic Reasoning. Algorithms, Recurrence relation. Graph Theory, and Theory of Automata.

Course Contents:

1. **Graph Theory** **(15 hrs)**
   - 1.1 Definitions
   - 1.2 Directed and Undirected Graphs
   - 1.3 Walk, Path, Circuits,
   - 1.4 Connected Components. Connected Component Algorithm
   - 1.5 Shortest –Path Algorithms
   - 1.6 Computer representation a graph (Static Representation only, like Adjacency Matrix, Incidence Matrix, Path Matrix)
   - 1.7 Bi-partite graphs
   - 1.8 Regular graphs
   - 1.9 Planar graphs
   - 1.10 Euler graph
   - 1.11 Hamilton graph and their properties and characterization.
   - 1.12 Application of graph theory in computer science (with example).

2. **Logic and Induction** **(8 hrs)**
   - 2.1 Propositions and Truth functions
   - 2.2 Predicates and Quantification
   - 2.3 Propositional and Predicate Logic
   - 2.4 Expressing statement in the language of Logic
   - 2.5 Deduction in Predicate Logic
   - 2.6 Elementary Step-wise Induction and Complete Induction.

3. **Introduction to Mathematical Reasoning** **(7 hrs)**
   - 3.1 Formal Languages and Inductive Definitions: Axioms,
   - 3.2 Rules of Inference and Proofs
   - 3.3 Direct Proof and Indirect Proof
   - 3.4 Formal Proof and Informal Proof.

4. **Recurrence Relations** **(7 hrs)**
   - 4.1 Recursive Definition of Sequences
   - 4.2 Differencing and Summation
   - 4.3 Solution of Linear Recursive Relation
   - 4.4 Solution of Non-linear Recurrence Relation.

5. **Finite State Automata** **(8 hrs)**
   - 5.1 Alphabets and Language
   - 5.2 Notion of a State
   - 5.3 State Machine (FSM and DFA)
   - 5.4 Regular Expression
   - 5.5 Equivalence Relation.

References:

1. Richard Johnsonbaugh, Discrete Mathematics, Fifth Edition, Addison Wesley, Pear Education Asia (LPE), ISBN: 81-780-82799, 2000
2. Mott, Joe L., Kandel Abraham and Baker, Theodoe P., Discrete Mathematics for Compu Scientists and Mathematicians, Second Edition, Prentice-Hall, ISBN: 81-203-1502-2
3. Liu, C.L., Elements of Discrete Mathematics, TMH, 2000, ISBN: 0-07-043476-X
4. Trus, J., Discrete Mathematics for Computer Scientists, Second Edition, Addision Wes ISBN: 0-201-36061,1999

ELE 211 Network Theory (3-1-2)

Evaluation:

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

Course Objectives:
The purpose of the course is to provide the knowledge of network equations and the behavior o network. Moreover, it provides in-depth knowledge to develop one-port and two port networks with given network functions.

Course Contents:

1. **Review of Network Analysis** **(2 hrs)**
   Mesh and Nodal analysis

2. **Circuit Differential Equations (Formulation and Solutions)** **(5 hrs)**
   2.1 The differential operator
   2.2 Operational impedance
   2.3 Formulation of circuit differential equations
   2.4 Complete response (transient and steady state) of first order differential equations with or without initial conditions

3. **Circuit Dynamics** **(7 hrs)**
   3.1 First order RL and RC circuits
   3.2 Complete response of RL and RC circuit to sinusoidal input
   3.3 RLC circuit
   3.4 Step response of RLC circuit
   3.5 Response of RLC circuit to sinusoidal inputs
   3.6 Damping factors and Damping Coefficients.

4. **Review of Laplace Transform** **(5 hrs)**
   4.1 Definition and properties
   4.2 Laplace transform of common forcing functions
   4.3 Initial and final value theorem
   4.4 Inverse Laplace transform
   4.5 Partial fraction expansion
   4.6 Step response of RL, RC and RLC circuit
   4.7 Sinusoidal response of RL, RC and RLC circuits
   4.8 Exponential response of RL, RC and RLC circuits

5. **Transfer Functions** **(4 hrs)**
   5.1 Transfer functions of network system

5.2 Poles and Zeros
5.3 Time domain behavior from pole-zero locations
5.4 S Routh'- Hurwitz's stability Criteria

(4 hrs)

6. Fourier Series and Transform

6.1 Evaluation of Fourier coefficients for periodic non-sinusoidal waveform
6.2 Fourier Transform
6.3 Application of Fourier transforms for non-periodic waveforms

7. Frequency Response of Network **(7 hrs)**

7.1 Magnitude and phase responses
7.2 Bode plots and its applications
7.3 Concept of ideal and non-ideal low pass, high pass, band pass, and band reject filters

8. One-port Passive Network **(7 hrs)**

8.1 Properties of one-port passive network
8.2 Positive Real Function
8.3 Properties of RL, RC and LC network
8.4 Synthesis of RL,RC and LC networks using Foster's and Cauer's method
8.5 Properties of RLC one-port network

9. Two-port Passive Network **(7 hrs)**

9.1 Properties of two-port network
9.2 Reciprocity and symmetry
9.3 Short circuit and Open circuit parameters
9.4 transmission parameters
9.5 Hybrid parameter
9.6 Relation and transformations between sets of parameters
9.7 Equivalent T and π section representation

Laboratory:

1. Transient and steady state responses of first order Passive network
   1.1 Measurement of step, impulse and ramp response of RC and RL circuit using oscilloscope
   1.2 Measurement of sinusoidal response of RC and RL circuit using oscilloscope
2. Transient and Steady state responses of second order Passive network
   2.1 Measurement of step, impulses and ramp response of RLC series and parallel network using oscilloscope
   2.2 Measurement of sinusoidal response of RLC series and parallel network using oscilloscope
3. Measurement of Frequency responses of first order and second order circuits
4. Measurement of Harmonic content of a waveform
5. Conversion of a T network into a network and measurement of network response
6. Synthesis of one-port network function and verify the responses using oscilloscope

Text Book:

1.. M.E., Van Valkenburg *Network Analysis*, Third Edition Prentice Hall of India, 1995.

References:

1. M. L. Soni, and J. C. Gupta, *Course in Electrical Circuits Analysis*, Dhanapat Rai & Sons, India.
2. K.C. Ng, *Electrical Network Theory*, A.H. Wheeler and Company (P) Limited, India.

ELX 210 Electronic Devices (3-1-2)

Evaluation:

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

Course Objectives:
The purpose of the course is to provide knowledge of principles of electronic devices and circuits. Moreover, it provides a method for analysis of semiconductor devices.

Course Contents:

1. **Semiconductor diode** **(8 hrs)**
   - 1.1 Review of conduction in semiconductors
   - 1.2 Theory of p-n junction
   - 1.3 Band structure of p-n junction
   - 1.4 The p-n junction as a diode
   - 1.5 The effects of temperature in V-I characteristics
   - 1.6 Space- charge of transition region capacitance and its effects
   - 1.7 Diffusion capacitance and its effects
   - 1.8 Diode switching times
   - 1.9 Zener diode
   - 1.10 Tunnel diode
   - 1.11 Construction
   - 1.12 Characteristics and Applications of Schottky diode
   - 1.13 Varactor diode and Metal Oxide Varister

2. **Non-Linear Model** **(2 hrs)**
   - 2.1 Basic properties of non-linear elements
   - 2.2 Non-linear circuit analysis (Graphical/ Algebraic analysis methods)
   - 2.3 Piecewise linear modeling
   - 2.4 Use and application of SPICE in analysis

3. **Bi-polar Junction Transistor (BJT)** **(7 hrs)**
   - 3.1 Construction of a BJT
   - 3.2 Working principal of BJT
   - 3.3 Modes of operation Transistor Configuration
   - 3.4 Analytical expression for transistor characteristics
   - 3.5 Input-output characteristics of CB, CE and CC transistor configurations
   - 3.6 α,β,γ and their relationship
   - 3.7 Avalanche effect
   - 3.8 Early Effect
   - 3.9 Reach – through

3.10 The EBERS-Moll equations
3.11 BJT switching time
3.12 Maximum voltage rating

4. **BJT biasing and Thermal Stabilization** **(6 hrs)**
   4.1 Biasing and its needs
   4.2 Types of biasing (fixed bias, collector to bias, Voltage divider or self-bias)
   4.3 DC/AC load line, Quiescent or Qpoint
   4.4 Stability and stability factor of biasing circuit
   4.5 Design of biasing circuit
   4.6 Bias compensation (diode compensation for V_{BE} and I_{CO})
   4.7 Thermal runway and stability.

5. **The Small Signal Low Frequency Analysis Model of BJT** **(7 hrs)**
   5.1 Low frequency hybrid model
   5.2 Measurement of h parameter
   5.3 Transistor configurations and their hybrid model
   5.4 Expression for Current gain, Voltage gain, input impedance and output impedance of two port BJT network
   5.5 Analysis of a transistor amplifier circuit using h-parameters
   5.6 Expression for voltage gain, current gain, input impedance and output impedance of CE, CB and CC configurations using h-model
   5.7 Comparison of characteristics of CB, CE and CC, Transistor as an amplifier

6. **The Junction Field Effect Transistor (JFET)** **(6 hrs)**
   6.1 Comparison between BJT and JFET
   6.2 Construction and types of JFET, Working Principal of JFET
   6.3 The pinch-off voltage and its importance
   6.4 Drain and transfer characteristics
   6.5 Trans-conductance, Biasing and load line
   6.6 V-I characteristics
   6.7 Configuration of JFET (CS, CD, CG), small signal model and analysis of CS, CD, CG, generalized FET Amplifier
   6.8 Uni-Junction transistor

7. **The Metal Oxide Semiconductor** **(3 hrs)**
   7.1 Construction and Working Principles of DMOSFET, EMOSFET, and CMOS load line biasing
   7.2 V-I characteristics
   7.3 Small signal analysis Model of MOSFET

8. **Clippers, Champers and Rectifiers** **(6 hrs)**
   8.1 Rectifier, Half Wave and Full Wave (Center tapped and Bridge) rectifier
   8.2 Average Value RMS value
   8.3 Ripple factor, Rectification efficiency, Form factor of half wave and full wave rectifier
   8.4 Diode clipper and Clamper harmonic components

8.5 Filters: inductor and capacitor filters- L section and P-I section filters

Laboratory:

1. Familiarization with equipment
2. Measurement of characteristics of PN Diode and Zener diode
3. Study of half wave and full wave rectifier circuits
4. Study of full wave rectifier (Center tap and Bridge) rectifier circuits
5. Study of Clipper Circuits
6. Measurement of input and output characteristics of CB, CE configurations
7. Measurement of input and output characteristics of JFET
8. Measurement of input and output characteristics of NMOS
9. Measurement of input and output characteristics of PMOS
10. Measurement of input and output characteristics of CMOS

Text Books:

1. S. Sedra and KC. Smith, *"Microelectronics Circuits"* Holt Rinebart and Winston, Ne York.
2. J Milliman and Halkias, *"Electronics Devices and Circuits"* Mc Graw Hill
3. T.F Bogart "*Electronic Devices and Circuits*" PHI
4.

References:

1. V.K Mehta, "principles *of Electronics* "S Chand & Co. Fifth edition
2. MN. Horenstein," *Microelectronic Circuits and Devices*" second edition, Prentice Hall o india
3. Dhruba Banjade, Electronic Devices, Sukunda Prakashan, Kathmandu, Nepal