MTH 112 Engineering Mathematics I (3 – 2 – 0)

Evaluation:

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

Course Objectives:

After the completion of this course students will be able to apply the concept of calculus (Differential and integral), analytical geometry and vector in their professional courses.

Course Contents:

1. Limit, Continuity and Derivative **15 hrs**

1.1 Limit, continuity and Derivative of a function with their properties
1.2 Mean values Theorem with their application
1.3 Higher order derivative
1.4 Indeterminate forms
1.5 Asymptote
1.6 Curvature
1.7 Ideas of curve tracing
1.8 Extreme values of functions of single variables

2. Integration with its Application **17 hrs**

2.1 Basic integration, standard integral, definite integral with their properties
2.2 Fundamental theorem of integral calculus (without proof)
2.3 Improper integral
2.4 Reduction formulae and use of beta Gamma functions
2.5 Area bounded by curves
2.6 Approximate area by Simpsons and Trapezoidal rule,
Volume of solid revolution

3. Two-Dimensional Geometry **7 hrs**

3.1 Review (circle, Translation and rotation of axes)
3.2 Conic section (parabola, ellipse, hyperbola),
3.3 Central conics (Introduction only)

4. Vector Algebra **6 hrs**

4.1 Review of vector and scalar quantity
4.2 Space coordinates
4.3 Product of two or more vectors
4.4 Reciprocal system of vectors and their properties
Equations of lines and planes by vector methods

Text Books:

1. Engineering Mathematics I: Prof. D.D Sharma (Regmi), Toya Narayan Paudel, Hari Pras Adhikari, Sukunda publication Bhotahity, Kathmandu
2. Calculus and analytical geometry: George B Thomas, Ross L. Finney

References:

1. Calculus with analytical geometry: E.W. Swokoswski.
2. Coordinate Geometry: Lalji Prasad.
3. Vector Analysis: M. B. Singh
4. Integral Calculus: G.D. Panta.

PHY 111 Physics (4 – 2 – 2)

Evaluation:

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

Course Objectives:

The main objectives of this course are:

1. To apply the theory of simple Harmonic motion in different elastic systems.
2. To apply theory of wave propagation and knowledge of resonance.
3. To apply and analyze the Optical properties in different optical systems.
4. To make use of fundamentals of electromagnetic equipment.
5. To use the knowledge of basic physics in different engineering fields.

Course Contents:

1. **Mechanical Oscillation** **4 hrs**
   Introduction and equation of Simple Harmonic Motion, energy in Simple Harmonic Motion, oscillation of mass –spring system, compound pendulum

2. **Wave Motion** **4 hrs**
   Introduction of wave, wave velocity and particle velocity, types of waves, equation, energy, power and intensity of plane progressive wave, standing wave and resonance

3. **Acoustics** **4 hrs**
   Reverberation of sound, absorption coefficient, Sabines formula, introduction, production and applications of ultrasonic wave

4. **Physical Optics** **8 hrs**
   Interference: introduction, coherent sources, interference in thin films due to reflected and transmitted light, Newton's Ring (3)
   Diffraction: introduction, fraunhoffer diffraction at single silt and double silt diffraction grating (2)
   Polarization: introduction, double refraction, Nicol prism, optical activity, specific rotation, wave plates (3)

5. **Laser and Fiber Optics** **4 hrs**
   Introduction of laser, spontaneous and stimulated emission, optical pumping, He-Ne laser, Ruby Laser, use of laser, Propagation of light waves, types of optical fiber, applications of optical fiber

6. **Electrostatics** **8 hrs**
   Electric charge, electric force, electric flux, electric potential, Gauss law and its applications, electric field intensity and electric potential due to dipole, electric potential due to quadrupole,

capacitors, electrostatic potential energy, dielectrics and gauss law charging and discharg of capacitor

7. Electricity and Magnetism 10 h

Electric current, resistance, resistivity and conductivity, atomic view of resistivity, magn field, magnetic force, Lorentz force, Hall effect, Biot-Savart's law and its applications, fo between two parallel conductors, Ampere's circuital law and its applications, Faraday's l of electromagnetic induction, self-induction R-L circuit, energy stored in magnetic field a magnetic energy density

8. Electromagnetism 9 hr

LC oscillation, Damped oscillation, forced oscillation and resonance, Maxwell's equati displacement current, wave equations in free space, continuity equation, E and B fie poynting vector, radiation pressure

9. Photon and Matter Waves 4 hr

Photon, group velocity and phase velocity, De brogile wavelength, Schrodinger w equation, one dimensional potential well, tunneling effect

10. Semiconductors and Super Conductivity 5 hr

Introduction, types of semiconductors Dopping, P-N Junction, Metal- semiconductor junct junction breakdown, junction capacitance, electrical conduction in metals, insulators semiconductors according to band theory of solids, introduction to superconductor

Text Books:

1. Fundamental of Physic by Robert Rescnick and David Hallday
2. A text book of optics by Subramanyam and Brijlal
3. Modern physics by R. Murugason

References:

1. Concept of physic by H.C Verma
2. Modern Engineering Physic by A.S Basudeva
3. Electronics by B.L Thereja
4. Principles of Electronics, V. K. Meheta

Laboratories:

1. To determine the acceleration due to gravity & radius of gyration by single bar pendulum.
2. To determine the frequency AC mains by using son mater apparatus
3. To determine the wave length by using diameter of Newton's ring
4. To determine the wave length of laser light by using diffraction grating
5. To determine the value of Modulus of Elasticity of the material given and Moment of Inertia of Circular disc using torsional pendulum
6. To determine the capacitance of given capacitor by charging and discharging through resistor

7. To determine the low resistance of a given wire and resistance per unit length of the wire by using Carey-foster bridge
8. To plot a graph current and frequency in an LRC series circuit and to find: i) the resonance frequency ii) the quality factor

Lab textbook: B. Sc Practical Physics by C. L. Arora

MEC 111 Thermal Science (2 – 1 – 2)

Evaluation:

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

Course Objectives:

The broad objective of this course is to provide working knowledge of theories and applications of thermal science. The specific objectives of the course are:

1. To make able to apply laws of thermodynamics in various systems.
2. To make able to distinguish the cycles in various engines, and pumps.
3. To make able to calculate energy/quantity of heat transfer by conduction and radiation

Course Contents

1. Concept and Definitions **2 hrs**

Thermodynamics, Applications of thermodynamics, Thermodynamic system, Macroscopi and microscopic and microscopic Approaches,

Properties and state of a substance: Thermodynamic properties and types, State, path process, cycle.

- Processes (definition, characteristics, features, Examples): Quasi-equilibriu (states) process, Reversible process, Irreversible process,
- Specific volume, Pressure, Atmospheric pressure, Gauge pressure, Absolut pressure
- Equality of temperature: Zeroth law of thermodynamics

2. Properties of Pure Substances **3 hrs**

- Pure substance: Homogenous in composition, Homogenous in chemical aggregatio Invariable in chemical aggregation
- Vapour-liquid solid phase equilibrium in pure substance: Steam generation(formatio process from ice to steam, Wet steam and quality, T-v diagram of water, P-v Diagra of water, P-t diagram of water
- Equations of state for a simple compressible substance:
- Tables and diagrams of thermodynamic properties
- Determination of Specific volume, Specific enthalpy and Specific entropy of wet an superheated steam

3. Work and Heat **2 hrs**

Definition of work: in mechanics and in thermodynamics,

Work done in quasi-equilibrium process

Displacement work, Work done in different reversible processes:

- Isochoric process
- Isobaric process
- Isothermal process

- Polytrophic process

Definition of heat: comparison between heat and work

First Law of Thermodynamics **4 hrs**

- First law for cycle: First law for closed system undergoing a cycle, Verification of this low by wheel paddle experiment
- First law for process: Difference between stored and internal energy, Stored energy
- Internal energy: Joule's law and its verification
- Enthalpy
- Specific heats: Specific heat capacity of gas at constant volume, Specific heat capacity of gas constant pressure
- First law as a rate equation:
- Conversation of mass and the control volume
- First law for control volume
- **Steady state steady flow process:** Assumption, Steady state steady flow energy equation(SFEE), Application of SFEE: Heat exchanger, nozzle, diffuser, turbine, Rotary compressor, Throttling device, Boiler
- Uniform state uniform flow process: Assumptions, 1st law for uniform state uniform flow process

Second Law of Thermodynamics **3 hrs**

- **Heat engines:** 4 components diagram and the schematic diagram, efficiency
  Refrigerator and heat pump: 4 components diagram and schematic diagram, COP of refrigerator and heat pump
- **Second law:** Limitation of first law of thermodynamics, Kelivn-Plank statement, Clausius statement
  - Equivalence of Kelvin-Plank and Clausius statements:
  - Factors causing irreversibility
  - Carnot theorem
  - Thermodynamic temperature scale

Entropy **4 hrs**

Inequality of Clausius, Entropy as a property of a system, Entropy of pure substance, Entropy change in reversible process, lost work, principle of increase of entropy, Entropy change of an ideal gas, the poly-topic process for an ideal gas, concepts of reversibility, irreversibility and availability

Some Power Cycles **4 hrs**

- Vapor Power Cycles: Rankine cycle (working process, efficiency, Effect of pressure and temperature on Rankine cycle)
- Air Standard Cycles: Air standard cycles: Carnot cycle (Working processes & Efficiency), Brayton cycle (Working processes & Efficiency)
- Internal combustion engines: Otto cycle (Workings processes & Efficiency), Diesel cycle (Working processes & Efficiency), Comparison between Otto an diesel cycle

8. Heat Transfer **7 hr**

- Modes of heat transfer: Conduction, Convection, radiation
- Conduction: Fourier's law (Statement, Mathematical modeling, Assumption for this la Thermal conductivity
- One dimensional steady state heat conduction: Through a plane, Through a holl cylinder, Through a hollow sphere
- Composite wail: Heat flow through multilayer plane slabs, Numerical on wall of plan cylinders and spheres in series.
- Thermal resistance and conductance: Electrical analogy of the conduction heat flow
- Overall heat transfer co-efficient: Heat transfer through a plane slab separating two fl media
- Basic laws of radiation: Emissive power and emissivity, Stefan-Boltzmann's l Kirchhoff's law, Wei's displacement law
- Black and gray bodies: Reflectivity, absorptive and transmissibility, Black and g bodies
- Radiant exchange between infinity parallel planes
- Newton's law
- Mechanism of forced and free convection
- Dimensionless parameters: Reynold's number, Nusselt's number, Pradndtl's numbe

9. Introduction to Refrigeration System

Introduction, Refrigeration cycle **1 hr**

Laboratory Work:

1. To measure the pressure, specific volume and temperature
2. To find out the efficiency of a compressor.
3. To measure the rate of heat transfer by conduction.
4. To measure performance of a small internal combustion engine
5. To measure the heat transfer by thermal radiation.
6. To measure the performance of a Refrigeration/Heat pump

Text Book:

1. Howell J.R. and R. O. Buckius, *Fundamentals of Engineering Thermodynamics*, McGro Hill Publishers, 1994.

References:

1. Van Wylen, G. J. and Richard E. Sonntag, *Fundamentals of Classical Thermodynami* Wiley Eastern Limited, New Delhi, 1989.
2. Bayazitoglu, Y. and M. Necati Ozisik, *Elements of Heat Transfer*, McGraw-Hill Bo Company, 1998.
3. Kreith, F., *Principles of Heat Transfer*, International Text book Company, Scran Pennsylvania, 2nd Edition, 1965.

CMP 113 Programming in C (3 – 0 – 3)

Evaluation:

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

Course Objectives:

The object of this course is to acquaint the students with the basic principles of programming and development of software systems. It encompasses the use of programming systems to achieve specified goals, identification of useful programming abstractions or paradigms, the development of formal models of programs, the formalization of programming language semantics, the specification of program, the verification of programs, etc. the thrust is to identify and clarify concepts that apply in many programming contexts:

Course Contents

1. **Introduction** **3 hrs**
   History of computing and computers, programming, block diagram of computer, generation of computer, types of computer, software, Programming Languages, Traditional and structured programming concept

2. **Programming Logic** **5 hrs**
   Problems solving (understanding of problems, feasibility and requirement analysis) Design (flow Chart & Algorithm), program coding (execution, translator), testing and debugging, Implementation, evaluation and Maintenance of programs, documentation

3. **Variables and Data Types** **3 hrs**
   Constants and variables, Variable declaration, Variable Types, Simple input/output function, Operators

4. **Control Structures** **6 hrs**
   Introduction, types of control statements- sequential, branching- if, else, else-if and switch statements, case, break and continue statements; looping- for loop, while loop, do—while loop, nested loop, goto statement

5. **Arrays and Strings** **6 hrs**
   Introduction to arrays, initialization of arrays, multidimensional arrays, String, function related to the strings

6. **Functions** **6 hrs**
   Introduction, returning a value from a function, sending a value to a function, Arguments, parsing arrays and structure, External variables, storage classes, pre-processor directives, C libraries, macros, header files and prototyping

7. **Pointers** 7 hr

Definition pointers for arrays, returning multiple values form functions using pointer Pointer arithmetic, pointer for strings, double indirection, pointer to arrays, Memor allocation-malloc and calloc

8. **Structure and Unions** 5 hr

Definition of Structure, Nested type Structure, Arrays of Structure, Structure and Pointer Unions, self-referential structure

9. **Files and File Handling** 4 hr

Operating a file in different modes (Real, Write, Append), Creating a file in differen modes (Read, Write, Append)

Laboratory:

Laboratory work at an initial stage will emphasize on the verification of programming concep learned in class and use of loops, functions, pointers, structures and unions. Final project of hours will be assigned to the students which will help students to put together most of th programming concepts developed in earlier exercises.

Text Books:

1. Programming with C, Byran Gottfried
2. C Programming, Balagurusami

References:

1. A book on C by A L Kely and Ira Pohl
2. The C Programming Language by Kerighan, Brain and Dennis Ritchie
3. Depth in C, Shreevastav

ELE 110 Basic Electrical Engineering (3 – 1 – 2)

Evaluation:

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

Course Objectives:

1. To analyze electric circuits (A.C. & D. C).
2. To work on electrical instrumentation projects.
3. To operate, distinguish and use electrical devices and machines.

Course Contents

1. **Introduction** **2 hrs**
   Role of electricity in modern society, Energy sources and production, generation, transmission and distribution of electrical energy, consumption of electricity

2. **DC Circuit Analysis** **15 hrs**
   Circuits concepts (lumped and distributed parameters), linear and nonlinear parameter, passive and active circuits, Circuit elements (Resistance, capacitance and inductance), their properties and characteristics in a geometrical and hardware aspects, color coding, Series of parallel compilation of resistances, Equivalent resistance and its calculation, star-delta transformation, concept of power, energy and its calculations, short and open circuit, ideal and non-ideal sources, source conversion, voltage divider and current divider formula, Kirchhoff's current and voltage laws, nodal method and mesh method of network analysis (without dependent source), network theorem (i.e. Superposition, Thevonin's, Norton's), maximum power transfer

3. **Single Phase AC Circuits Analysis** **10 hrs**
   Generation of EMF by electromagnetic induction, Generation of alternating voltage, 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, 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, resonance in series and parallel RLC circuit, bandwidth, effect of Q factor in resource

4. **Poly-phase AC Circuit Analysis** **6 hrs**
   Concept of a balanced three phase supply, generation and differences between single phase over three phase system, star and delta connected supply and load circuits. Line and phase voltage\current relations, power measurement, concept of three phase power and its measurement by single and two wattmeter methods

5. **Electric Machines** 12 hr

Review of magnetic circuits

Transformers: Principle of operations, features, equivalent circuits, efficiency & regulation, open circuit & short circuit tests

DC motors: Performance & operation, basic characteristics of motors & generators speed control & selection of motors

AC machines: Induction motors (working principles, construction features and uses) Synchronous motors (working principles, construction and uses

Text Books:

1. Boylested, Albert "Introduction of Electric circuit" Prentice Hall of India Private Limited New Delhi
2. Tiwari, S.N, "A first course of electrical engineering" att. Wheeler & Co. Ltd. Allabhad

References:

1. Thereja B. L & Thereja A. K. "A text book of Electrical Technology, S Chand Publication
2. Jain& Jain" ABC of Electrical Engineering"

Laboratory Work:

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 dire 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.
   i. Varying the field current with armature voltage held constant field control.
   ii. 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)
    i. To determine magnetization characteristics
    ii. To determine V-I characteristics of a dc shunt generator