MTH 211.3 Engineering Mathematics III (3-2-0)

Evaluation:

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

Course Objectives:

The main objectives of this course is to provide the basic knowledge of linear algebra, vector calculus, fourier series, linear programming by graphical and simplex methods. After the completion of this course, students can use their knowledge in their professional course.

Course Contents:

1. Matrix and Determinant: (8 hrs)

1.1 Review of Matrix and determinant with their properties
1.2 System of linear equation with their solutions by Gauss elimination methods
1.3 Rank of matrix
1.4 Consistency of system of linear equation
1.5 Vector space and sub space
1.6 Linear transformation
1.7 Eigen values and vectors, Cayley Hamilton theorem (statement only) and its application.

2. Vector Calculus (16 hrs)

2.1 Differentiation and integration of vectors
2.2 Gradient, divergence and curl with their properties (without proof)
2.3 Line integral: Definition of line integral, Evaluation of line integral, properties, Greens theorem, Area by Greens theorem
2.4 Surface integral: Surface integral, tangent planes, Gauss divergence theorem, Dirichelet integral
2.5 Stokes theorem

3. Infinite series (8 hrs)

3.1 Sequence and series
3.2 Necessary condition of convergence of infinite series
3.3 P-test (hyper-harmonic test)
3.4 Ratio test
3.5 Root test
3.6 Integral test
3.7 Leibnitz test and absolute convergence

3.8 Interval of convergence of power series.

3.9 Taylor and Maclaurin expansion (statement only) and its application

4. Fourier Series **(6 hrs)**

4.1 Periodic function, Trigonometric series, even and odd function

4.2 Fourier series of a function with period 2π and arbitrary period 2L

4.3 Fourier sine and cosine series representation of the half range function

5. Linear Programming **(7 hrs)**

5.1 System of Linear Inequalities

5.2 Linear Programming

- 5.2.1 Model Formulation
- 5.2.2 GraphicalSolution
- 5.2.3 Simplex method
- 5.2.4 The Dual model
- 5.2.5 Dual Simplex Method

Text Books:

1. Kreyszig, Erwin.*Advance Engineering Mathematics*(8th edition). New Delhi:Wiley-Easter Publication.

2. Paudel, Toya Narayan.*Engineering Mathematics III*, Bhotahity: Sukunda publication.

References:

1. Thomas, George B.& Finney,Ross L.*Calculus and Analytical Geometry.*

2. Swokoswski, E.W.*Calculus with Analytical Geometry.*

3. Singh, M.B.*Vector Analysis.*

4. Pant, G. D.*Algebra.*

CMP 331.3 Data Structure and Algorithm (3-1-3)

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 fundamental knowledge on data structure designing and implementation for storing information. Moreover, it provides the knowledge of various algorithms used in computer science.

Course Contents:

1. **Introduction to Data Structure and algorithms** **(3hrs)**
   1.1. Review of Array, Structure, Union, Class, Pointer
   1.2. Abstract data type
   1.3. Data Structure Concept

2. **The Stack** **(4hrs)**
   2.1. Definition and Primitive Operations
   2.2. Stack as an ADT, Stack operations
   2.3. Stack application
   2.4. Evaluation of Infix Postfix and prefix expressions.
   2.5. Expression Conversion

3. **Queue** **(3hrs)**
   3.1. Definition, Queue as an ADT and Primitive operations in queue
   3.2. Linear and circular queue and their application
   3.3. Double Ended Queue
   3.4. Priority queue

4. **Static and Dynamic List** **(8hrs)**
   4.1. Definition and Array implementation of lists
   4.2. Queues as a list
   4.3. Link List Definition and link list as an ADT
   4.4. Dynamic implementation
   4.5. Basic operations in linked list
   4.6. Doubly linked lists and its advantages
   4.7. Implementation of Doubly Linked List

4.8. Linked Implementation of stacks and Queues,

5. Recursion **(2hrs)**

5.1. Principle of recursion and Comparison between recursion and iteration
5.2. Factorial, TOH and Fibonacci sequence
5.3. Applications of recursion and Validity of an Expression

6. Trees **(7hrs)**

6.1. Concept and definitions
6.2. Basic operation in binary tree
6.3. Binary search tree and insertion /deletions
6.4. Binary tree traversals (preorder, post order and in order) tree height level and depth
6.5. Balanced trees
6.6. AVL balanced trees
6.7. Balancing algorithm
6.8. The Huffman algorithm
6.9. Game tree
6.10. B- Tree.

7. Sorting **(5hrs)**

7.1. Internal and external sort
7.2. Insertion and selection sort
7.3. Exchange sort
7.4. Bubble and quick sort
7.5. Merge and Radix sort
7.6. Shell sort
7.7. Heap sort as priority queue
7.8. Efficiency of sorting.

8. Searching **(3hrs)**

8.1. Search technique essential of search
8.2. Sequential search
8.3. Binary search
8.4. Hashing :
8.5. Hash function and hash tables ,
8.6. Collision resolution technique ,
8.7. Efficiency comparisons of different search technique.

9. Graphs **(8hrs)**

9.1. Representation and applications
9.2. Graphs as an ADT
9.3. Transitive closure and Wars hall's algorithm

9.4. Graphs types
9.5. Graphs traversal and spanning forests
9.6. Kruskal 's and Round Robin algorithms
9.7. Shortest-path algorithm
9.8. Greedy algorithm
9.9. Dijkstra's Algorithm

10. Algorithms **(2hrs)**

10.1. Deterministic and no-deterministic algorithm
10.2. Divide and conquer algorithm
10.3. Series and Parallel algorithm
10.4. Heuristic and Approximate algorithm.
10.5. Big O Notation

Laboratory:

There shall be lab exercises based on C or C++

1. Implementations of stack
2. Implementations of linear and circular queues
3. Solutions of TOH and Fibonacci Recursion
4. Implementation of linked list: singly and double linked
5. Implementation of trees; AVL tree Balancing of ALV
6. Implementation of merge sort
7. Implementation of search: sequential tree and binary
8. Implementation of Graphs: Graph traversals
9. Implementation of hashing
10. Implementation of heap

Text Books:

1. Y Langsam, MJ, Augenstein and A.M , Tenenbaum Data Structures using C and C++ , Prentice Hall India
2. G.W Rowe, Introduction to Data Structure and Algroithms with C and C++ , prentice Hall India

Reference Books:

1. R.L Kruse, B.P. Leung, C.L. Tondo, data structure and program Design in C Prentice hall India
2. G. Brassard and P. Bratley fundamentals of Algroithms, prentice hall India

ELE 226.2 Electrical Engineering Materials (2-2-0)

Evaluation:

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

Course Objectives:
The purpose of the course is to provide a basic understanding of the electric and magnetic properties of materials used in electrical and electronics engineering.

Course Contents:

1. **Theory of Metals** **(3 hrs)**
   1.1. Elementary quantum mechanical ideas
   1.2. Free electron theory, Energy well model of a metal and Density of states function
   1.3. The Fermi-Dirac distribution functions, Thermionic emission, Work function and The Fermi level at equilibrium, Contact Potential

2. **Free Electron Theory of Conduction in Metals** **(4 hrs)**
   2.1. Thermal velocity of electrons at equilibrium, Lattice scattering, Mean free time between collisions and Drift velocity of electrons in an electric field
   2.2. Diffusion of electrons, Diffusion coefficient, Einstein's relationship between mobility and diffusion coefficients
   2.3. Chemical and physical properties of common conduction of materials such as As, Au, Ag, Cu, Al, Mn, N etc.

3. **Conduction in Liquid and Gases** **(2 hrs)**
   3.1. Ionic conduction in electrolytes
   3.2. Electrical conduction in gas arc discharges in electric breakdown

4. **Dielectric Materials** **(4 hrs)**
   4.1. Macroscopic effects, Polarization, Dielectric constant and Dielectric losses
   4.2. Frequency and temperature effects and Dielectric breakdown
   4.3. Ferro electricity and piezoelectricity
   4.4. Properties of common dielectrics such as glass, Porcelain, Polyethylene, PVC, Nylon, bakelite, rubber, mica, transformer oil etc.

5. **Magnetic Materials** **(5 hrs)**

5.1. Ferromagnetism, Ferrimagnetisms, Para magnetism
5.2. Domain structure, Hysteresis loop, Eddy current losses, Soft magnetic materials
5.3. Fe-Si alloys, Ni-Fe alloys, ferrites for high frequency transformers
5.4. Square loop materials for magnetic memory, relaxation oscillators, hared magnetic materials such as carbon steels alnico and barium ferrites

6. Semiconducting Materials (8 hrs)

6.1. Band structure of group iv materials, Energy gap, density of states function
6.2. Femi-Dirac distribution function
6.3. Hole and electron densities in an intrinsic crystal
6.4. Effective densities of states, intrinsic concentration, Femi level of energy at equilibrium
6.5. Group iii and group iv impurities, acceptors and donors, p-and n-type materials
6.6. Energy band diagrams for uniformly-doped and graded p-and n-type materials
6.7. Generation PN, recombination of electrons and holes, concept of lifetime
6.8. Mobility and diffusion coefficients for electrons and holes in semiconductors
6.9. Transport and continuity equations for electrons and holes, concept of diffusion length, energy band diagram for a p-n junction
6.10. Contact potentials, metal-semiconductor contacts

7. Semiconductor Materials Procession (4 hrs)

7.1. Crystal growing, doping by solid state diffusion, ion implantation
7.2. Oxidation Photolithography, the planar process, metallization, contacts

Text Book:

R.A. Colcaseer Ands. Diehi-Nagle, *Materials and Devices for Electrical Engineers and Physicists*, McGraw-Hill, New York, 1985.

Reference:

R.C. Jaeger, *Introduction to Microelectronic Fabrication-Volume IV*, Addison-Wesley Publishing Company Inc., 1988.

CMP 213.3 Electronic Devices and Circuits (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 **(6 hrs)**

1.1 Review of insulator and semiconductor and conductors
1.2 Conduction in semiconductors
1.3 Theory of p-n junction
1.4 Forward and reverse biasing of diode
1.5 Diode as a non linear devices
1.6 Ideal and piecewise linear model of diode
1.7 The effects of temperature in V-I characteristic curves
1.8 Junction capacitances and its effects
1.9 Diode switching times
1.10 Junction breakdown
1.11 Construction, characteristics and applications of Zener diode, Schottky diode

2. Bi-polar Junction Transistor **(6 hrs)**

2.1 Introduction of bipolar junction transistor
2.2 Current flow mechanism in PNP and NPN transistors
2.3 Input and output characteristics of CE and CB transistor amplifiers
2.4 Reach through and punch through effects
2.5 Active and cut off and saturation modes of operations of BJT and BJT switching times
2.6 The transistor as an amplifier and a switch
2.7 Comparison of CB, CE and CC configurations
2.8 BJT biasing, dc load line, ac load line and Q point
2.9 Stability factor

3. DC Power supply **(5 hrs)**

3.1 Half wave and full wave rectifiers
3.2 Average value, RMS value ripple factor of half and full wave rectifiers
3.3 Filtering process, Shunt capacitor and LC filter and pi filter
3.4 Series Shunt and biased clipper circuits
3.5 Clamping circuits
3.6 Regulated and unregulated power supplies
3.7 Transistor series and transistor shunt regulators

4. The Field Effect Transistor (FET) **(5 hrs)**

4.1 Comparison between FET and BJT
4.2 Construction and working principle of JFET
4.3 Biasing and load line
4.4 Drain and transfer characteristics of JFET and JFET parameters
4.5 Small signal model and analysis of CS, CD and CG configurations
4.6 Construction and working principles of DMOSFET and EMOSFET

5. The Small Signal Low Frequency Analysis Model of BJT **(5 hrs)**

5.1 Low frequency hybrid model
5.2 Transistor configurations and their hybrid model.-Measurement of h-parameters and analysis of a transistor amplifier circuit using h-parameters
5.3 Low frequency r_e model, amplifier configuration and their expression for voltage gain, current gain, input impedance and output impedance using re model
5.4 Analysis of transistor amplifier circuit using r_e model
5.5 Emitter follower

6. Multistage Amplifiers **(4 hrs)**

6.1 Multistage amplifier and Gain calculation of n-stages cascaded amplifiers
6.2 Methods of coupling
6.3 Expression of voltage gains, Current gains, input and output impedance for two stages RC coupled amplifier using r_e model
6.4 Choice of configuration in a cascade
6.5 Darlington-pair amplifier and its effective beta

7. Large Signal Amplifiers **(4 hrs)**

7.1 Analysis of large signal model
7.2 Class A, B, AB and Class C amplifiers
7.3 Push-pull amplifiers
7.4 Cross over distortion
7.5 Transformer coupled push-pull stages
7.6 Amplifier efficiency, power dissipation and heat sinks

8. Feedback Amplifiers **(3 hrs)**

8.1 Negative feedback amplifiers and advantages of negative feedback
8.2 Gain stability, extension of bandwidth
8.3 Importance of positive feedback on oscillation

9. **Operational Amplifier and Oscillator** **(7 hrs)**
9.1 Basic Model
9.2 Ideal and non ideal properties
9.3 Virtual ground concept, offset voltage, input bias current, slew rate and CMRR
9.4 Inverting and non inverting amplifier
9.5 Integrator, differentiator and summing amplifier and their applications
9.6 Astable and monostable multivibrators
9.7 Barkhausen criteria for oscillation
9.8 RC phase shift and Wein bridge oscillator using Op-amp
9.9 Crystal oscillator

Laboratory:
1. Study of V-I characteristics of PN diode and Zener diode.
2. Study of half wave and full wave rectifiers.
3. Study of input and output characteristics of CE and CB transistor amplifier.
4. Measurement of gain in single stage and multistage amplifiers.
5. Measurement of efficiency of class A and Class B push pull power amplifiers.
6. Design of RC phase shift and Wein Bridge oscillator.
7. Measurement of Regulation in series regulator against change in input voltage and load resistance.
8. Study of drain characteristics of JFET.

Text Books:
1. Jacob Millman & Christors C. Halkias, *Electronic Devices and Circuits*, Tata McGraw Hill, India.
2. Theodore F. Bogart, *Electronic Devices and Circuits*, Univesal Book Stall, Indial.

References:
1. Roberst Boylestad & Louis Nashelsky, *Electronic Devices and Circuit Theory,* Prentice Hall, India.
2. Allen Mottershead, *Electronic Devices and Circuits*, Prenticre- Hall, India
3. Albert Paul Malvino, *Electronic Principles*, Tata Mc Graw Hill, India.
4. S. Sedra and K.C. Smith, *Microelectronic Circuits*, Holt, Rinehart and Inc., New York.
5. Dhruba Banjade. Electronic Devices, Sukunda Prakashan, Kathmandu, Nepal
6. Dhruba Banjade, Electronic Circuits, Yog Prakasahan, Kathmandu, Nepal.

ELX 212.3 Logic Circuits (3-1-3)

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 basic knowledge of logic systems. Moreover, it enables to design a basic digital computer.

Course Contents:

1. **Introduction** **(3 hrs)**
   1.1 Numerical representation
   1.2 Digital number system
   1.3 Digital and analog system

2. **Number System and Codes** **(6 hrs)**
   2.1 Binary to decimal and decimal to binary conversions
   2.2 Octal, hexadecimal number system and conversions
   2.3 Binary Arithmetic 1's complement and 9's complements
   2.4 Gray code
   2.5 Instruction codes
   2.6 Alphanumeric characters
   2.7 Modulo2 system and 2's complement
   2.8 Binary Coded Decimal (BCD) and hexadecimal codes
   2.9 Parity method for error detection

3. **Boolean Algebra and Logic Gates** **(4 hrs)**
   3.1 Basic definition
   3.2 Basic properties and theorem of Boolean algebra
   3.3 DeMorgan's Theorem
   3.4 Logic gates and truth tables
   3.5 Universality of NAND and NOR gates
   3.6 Tristate logic

4. **Simplification of Boolean Function** **(5 hrs)**
   4.1 Venn diagram and test vectors

4.2 Karnaugh maps up to five variables
4.3 Minimum realization
4.4 Don't care conditions
4.5 Logic gates implementation
4.6 Practical design steps

5. **Combination Logic** **(4 hrs)**
   5.1 Design procedure
   5.2 Adders and subtractors
   5.3 Code conversion
   5.4 Analysis procedure
   5.5 Multilevel NAND and NOR circuits,
   5.6 Parity generation and checking
6. **MSI and LSI Components in Combinational Logic Design** **(6 hrs)**
   6.1 Binary adder and subtractor,
   6.2 Decimal adder
   6.3 Magnitude comparator
   6.4 Decoder and encoder
   6.5 Multiplexer and demultiplexer
   6.6 Read-only memory (ROM)
   6.7 Programmable Logic Array (PLA)

7. **Sequential Logic** **(6 hrs)**
   7.1 Event driven model and state diagram
   7.2 Flip-flops and their types
   7.3 Analysis of clocked sequential circuits
   7.4 Decoder as memory devices
   7.5 State reduction and assignment
   7.6 Synchronous and asynchronous logic
   7.7 Edge triggered device
   7.8 Master slave flip-flops
   7.9 JK and T flip-flops

8. **Registers, Counters and Memory Unit** **(6 hrs)**
   8.1 Registers
   8.2 Shift registers
   8.3 Superposition of registers
   8.4 Generation of codes using registers
   8.5 Ripple
   8.6 Synchronous and Johnson Counters
   8.7 Design of multiple input circuits

8.8 Random Access Memory (RAM)
8.9 Memory decoding
8.10 Error-correction code
8.11 Output hazards races

9. **Arithmetic Logic Units** **(5 hrs)**
   9.1 Nibble adder
   9.2 Adder/ subtractor unit
   9.3 Design of arithmetic logic unit
   9.4 Status register
   9.5 Design of shifter
   9.6 Processor unit
   9.7 Design of accumulator

Laboratory Work:
1. Familiarization with logic gates.
2. Encodes and decodes
3. Multiplexer and demultiplexer
4. Design of simple combination circuits.
5. Design of adder/subtractor
6. Design of flip-flop
7. Design of counter
8. Clock driven sequential circuits
9. Conversion of parallel data into serial format.
10. Generation of timing signal for sequential system.

Text Books:

1. M. Mano, Digital Logic and Computer Design, Prentice Hall of India 1998.
2. M. Mano, Computer System Architecture, Prentice Hall of India, 1998.

Reference:

1. M. Mano, Digital Design, Prentice Hall of India, 1998.

ELE 215.3 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 of 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)**
   1.4 Mesh and Nodal analysis

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

3. **Circuit Dynamics** **(7 hrs)**
   3.7 First order RL and RC circuits
   3.8 Complete response of RL and RC circuit to sinusoidal input
   3.9 RLC circuit
   3.10 Step response of RLC circuit
   3.11 Response of RLC circuit to sinusoidal inputs
   3.12 Damping factors and Damping Coefficients.

4. **Review of Laplace Transform** **(5 hrs)**
   4.7 Definition and properties
   4.8 Laplace transform of common forcing functions
   4.9 Initial and final value theorem
   4.10 Inverse Laplace transform
   4.11 Partial fraction expansion
   4.12 Step response of RL, RC and RLC circuit

4.13 Sinusoidal response of RL, RC and RLC circuits
4.14 Exponential response of RL, RC and RLC circuits

5. Transfer Functions (4 hrs)

5.7 Transfer functions of network system
5.8 Poles and Zeros
5.9 Time domain behavior from pole-zero locations
5.10 S Routh'- Hurwitz's stability Criteria

6. Fourier Series and Transform (4 hrs)

6.8 Evaluation of Fourier coefficients for periodic non-sinusoidal waveform
6.9 Fourier Transform
6.10 Application of Fourier transforms for non-periodic waveforms

7. Frequency Response of Network (7 hrs)

7.10 Magnitude and phase responses
7.11 Bode plots and its applications
7.12 Concept of ideal and non-ideal low pass, high pass, band pass, and band reject filters

8. One-port Passive Network (7 hrs)

8.12 Properties of one-port passive network
8.13 Positive Real Function
8.14 Properties of RL, RC and LC network
8.15 Synthesis of RL,RC and LC networks using Foster's and Cauer's method
8.16 Properties of RLC one-port network

9. Two-port Passive Network (7 hrs)

9.8 Properties of two-port network
9.9 Reciprocity and symmetry
9.10 Short circuit and Open circuit parameters
9.11 transmission parameters
9.12 Hybrid parameter
9.13 Relation and transformations between sets of parameters
9.14 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:

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

References:

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