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.