| Course code | Course Name | L-T-P-Credits | Year of Introduction |
|---|---|---|---|
| BM203 | NETWORK ANALYSIS | 3-1-0-4 | 2016 |

**Prerequisite :Nil**

**Course Objectives**

1. To understand the various Network theorem and apply them in biomedical circuits
2. To expose the students to the basic concepts of electric circuits and their analysis in time and frequency domain
3. To introduce the concept of filter circuits and design of passive filters
4. To introduce the techniques of network synthesis

**Syllabus**

Network theorems, Network topology, Transient analysis, S-Domain analysis of circuits, Network functions, Two-port network, Symmetrical two-port networks, Symmetrical two-port reactive filters, Attenuators, Elements of realizability theory, Driving point synthesis.

**Expected Outcome**

Students would be able to

(i) realize Network theorems and apply them in biomedical circuits.

(ii) analyze electric circuit in time and frequency domain.

**Text Books:**


1. Van Valkenberg, *Network Analysis*, Prentice-Hall of India.
2. D. Roy Choudhary, *Networks and Systems*, New Age International Publishers, Second Edition.


**Reference Books:**


1. Edminister, *Electric Circuits – Schaum's Outline Series*, McGraw-Hill.
2. Franklin F. Kuo, *Network Analysis and Synthesis*, Wiley India, Second Edition.
3. William H Hayt & Jack E Kemmerly, *Engineering Circuit Analysis*, TMH.


**COURSE PLAN**

| Module | Contents | Hours | Sem. Exam Marks |
|---|---|---|---|
| I | Thevenin's and Norton's theorems – Superposition theorem – Source transformations – Maximum Power Transfer theorem – Reciprocity theorem | 4 | 15% |
| | Definition of basic terms – Incidence matrix – Tie-sets and Cut-sets – Analysis and formulation of network equations using tie-set and cut-set | 3 | |
| | Response of RC, RL and LC networks to impulse and step inputs – Step response of RLC network | 3 | |
| II | Review of Laplace transform – Transforms of basic signals – Transformation of a circuit into S-domain – Transformed equivalent of inductance, capacitance and mutual inductance – Impedance and admittance in the transformed domain | 4 | 15% |
| | Nodal analysis and Mesh analysis of the transformed circuit | 2 | |
| | Impulse response and Transfer function – Poles and Zeros – Restriction of pole and zero locations of network functions - Steady state response and Frequency response from Laplace transform | 4 | |

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|---|---|---|---|
| **FIRST INTERNAL EXAM** | | | |
| **III** | Characterization in terms of Impedance, Admittance, Transmission and Hybrid parameters – Inter-relationships among parameter sets | **2** | **15%** |
| | Analysis of interconnected two-port networks – Series, Parallel and Cascade connections of two-port networks | **3** | |
| | T and π equivalent of a two-port network | **2** | |
| **IV** | Image impedance – Characteristic impedance and propagation constant of a symmetrical two-port network | **2** | **15%** |
| | Filter fundamentals – Pass and stop bands – Types of filtering – Brick wall specifications | **2** | |
| | Characteristic impedance – Design of Constant K – Low Pass, High Pass, Band Pass and Band Reject Filters | **2** | |
| | T and π sections – Design of m-derived Low Pass and High Pass filters. Types of attenuators, T and Bridged T attenuators - compensated attenuators | **3** | |
| **SECOND INTERNAL EXAM** | | | |
| **V** | Causality and Stability analysis of network functions – Hurwitz polynomials – Properties of Hurwitz polynomials | **4** | **20%** |
| | Positive real functions – Properties of positive real functions – Testing driving point functions | **3** | |
| | Application of maximum modulus theorems – Brune's positive real functions – Strum's theorem – Elementary synthesis procedures | **3** | |
| **VI** | Foster and Cauer forms of realization of network functions – Properties of driving point immittance functions of LC networks | **3** | **20%** |
| | Synthesis of LC driving point functions – Properties of RC driving point immittance functions, Synthesis of RC network functions | **4** | |
| | Properties of RL driving point immittance functions, Synthesis of RL network functions | **3** | |
| **END SEMESTER EXAM** | | | |

**QUESTION PAPER PATTERN:**

Maximum Marks: 100 Exam Duration: 3 Hours

There shall be three parts for the question paper.

**Part A** includes Modules 1 & 2 and shall have three questions of fifteen marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

**Part B** includes Modules 3 & 4 and shall have three questions of fifteen marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

**Part C** includes Modules 5 & 6 and shall have three questions of twenty marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

**Note**: Each part shall have questions uniformly covering both the modules in it.