# University of Kerala

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|---|---|---|---|---|---|
| Discipline | **PHYSICS** | | | | |
| Course Code | **UK3DSEPHY201** | | | | |
| Course Title | **CIRCUIT ELEMENTS AND NETWORK THEOREMS** | | | | |
| Type of Course | **DSE** | | | | |
| Semester | **III** | | | | |
| Academic Level | **200 - 299** | | | | |
| Course Details | Credit | Lecture per week | Tutorial per week | Practical per week | Total Hours/Week |
| | 4 | 4 Hrs | - | - | 4 Hrs |
| Pre-requisites | | | | | |
| Course Summary | This course aims to get knowledge on basic electrical technology, network theorems, circuit analysis. It also helps to understand the ac circuit analysis and an idea regarding optoelectronic devices. | | | | |

**BOOKS FOR STUDY**:

1. Basic Electronics Solid State: B. L. Theraja, S Chand & Company LTD.
2. Principles of Electronics, V K Mehta and Rohith Mehta, S Chand & Company LTD.
3. Basic Electronics: Devices, circuits and IT fundamentals: Santiram Kal, PHI, 2010

**DETAILED SYLLABUS: THEORY**

| Module | Unit | Content | Hrs | CO No |
|---|---|---|---|---|
| I | | **Ohm's Law (Book 1, Chapter 1,2&3)** | **12** | |
| | 1 | Linear and non-linear Resistors, Resistor Colour code | 2 | 1 |

| | | | | |
|---|---|---|---|---|
| | 2 | Resistor Types-Wire wound Resistors, Carbon composition Resistors, Carbon film Resistors, Metal film Resistors | 2 | 1 |
| | 3 | Resistive circuits, Series and Parallel Resistor circuits, Series aiding and Series opposing Voltages | 2 | 2 |
| | 4 | Proportional Voltage formula, Proportional Current formula, Series Voltage Dividers | 2 | 2 |
| | 5 | 'Open' and 'Short' in Series, Parallel and Series –Parallel Circuits. | 2 | 1,2 |
| | 6 | Cells in series and parallel | 2 | 1,2 |
| **II** | **Inductors and Capacitors (Book 1, Chapter 5)** | | **12** | |
| | 7 | Inductance, Inductor Types: Air core inductor, Iron-core Inductor, Ferrite-core Inductor | 2 | 1 |
| | 8 | Self-Induction, Mutual Induction, relation connecting self-inductance and mutual inductance | 2 | 1 |
| | 9 | Coefficient of Coupling, Inductors in Series or Parallel without M, series combination with M, | 2 | 2 |
| | 10 | Stray Inductance, Reactance offered by a Coil. | 1 | 1 |
| | 11 | Capacitance, Capacitors in Series and Parallel, Reactance offered by the Capacitor | 2 | 1 |
| | 12 | Type of Capacitors- Fixed Capacitors, Variable Capacitors | 1 | 1 |
| | 13 | Charging and discharging of a capacitor | 2 | 1,2 |
| **III** | **Network Theorems (Book 1, Chapter 4)** | | **12** | |
| | 14 | Ideal constant Voltage Source, Ideal constant Current Source | 2 | 1 |
| | 15 | Kirchhoff's Law | 2 | 2 |
| | 16 | Super position theorem | 2 | 3 |
| | 17 | Thevenin's and Norton's Theorem | 4 | 3 |
| | 18 | Maximum Power Transfer Theorem | 2 | 3 |
| **IV** | **Alternating Current (Book 1, Chapter 5)** | | **12** | |
| | 19 | Type of alternating waveforms, Different values of sinusoidal voltage and current, Phase and Phase difference of A.C | 2 | 1 |

| | | | | |
|---|---|---|---|---|
| | 20 | Non-sinusoidal waveform, Harmonics | 1 | 1 |
| | 21 | A.C through Resistor, Inductor, Capacitor | 2 | 2 |
| | 22 | L-R, R-C and LCR circuits | 3 | 2 |
| | 23 | Sharpness of resonance, Q-factor, Bandwidth | 2 | 5 |
| | 24 | Tuning of radio, Parallel LCR | 2 | 5 |
| **V*** | **Optoelectronic devices (Book 1, Chapter 16)** | | **12** | |
| | 25 | Light Emitting Diode (LED) – theory, construction and applications | 3 | 4,5 |
| | 26 | Photo Emissive Devices | 2 | 4 |
| | 27 | Photomultiplier Tube | 2 | 4 |
| | 28 | Photovoltaic Devices – bulk type photoconductive cells | 2 | 4,5 |
| | 29 | Photodiodes – P-N junction photodiode – PIN photodiode – avalanche photodiode. | 3 | 4,5 |

## COURSE OUTCOMES

| No. | Upon completion of the course the graduate will be able to | Cognitive Level | PSO addressed |
|---|---|---|---|
| CO-1 | Describe basic electronic components | U | PSO-1 |
| CO-2 | Analyse Series and Parallel Networks | Ap, E | PSO-1, 2 |
| CO-3 | Understand the basic network theorems | U | PSO-1,2 |
| CO-4 | Familiarize the different semiconductor devices | U | PSO-1 |
| CO-5 | Understand the V-I characteristics of the circuits | Ap | PSO-1 |

**R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create**

**Name of the Course: CIRCUIT ELEMENTS AND NETWORK THEOREMS**

**Credits: 4:0:0 (Lecture: Tutorial: Practical)**

| CO No. | CO | PO / PSO | Cognitive Level | Knowledge Category | Lecture (L)/ Tutorial (T) | Practical (P) |
|---|---|---|---|---|---|---|
| CO-1 | Describe basic electronic components | PO 1/ PSO 1 | U | C | L | - |
| CO-2 | Analyse Series and Parallel Networks | PO 1,2/ PSO 1,2 | Ap, E | C | L | - |
| CO-3 | Understand the basic network theorems | PO 1/ PSO 1,2 | U | C | L | - |
| CO-4 | Familiarize the different semiconductor devices | PO 1/ PSO 1 | U | F | L | - |
| CO-5 | Analyze the V-I characteristics of the circuits | PO 1,2/ PSO 1 | Ap | P | L | - |

**F-Factual, C- Conceptual, P-Procedural, M-Metacognitive**

**Mapping of COs with PSOs and POs :**

| | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 | PSO 7 | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO-1 | 1 | - | - | - | - | - | - | 1 | | - | - | - | - | - | - |
| CO-2 | 2 | 2 | - | - | 2 | - | - | 1 | 1 | - | - | - | - | - | - |
| CO-3 | 2 | 2 | - | - | - | - | - | 1 | - | - | - | - | - | - | - |
| CO-4 | 2 | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - |
| CO-5 | 1 | - | - | - | - | - | - | 1 | 1 | - | - | - | - | - | - |
| CO-6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

**Correlation Levels:**

| **Level** | - | 1 | 2 | 3 |
|---|---|---|---|---|
| **Correlation** | Nil | Slightly / Low | Moderate / Medium | Substantial / High |

**Assessment Rubrics:**

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

**Mapping of COs to Assessment Rubrics:**

| CO No | Internal Exam | Assignment | Project Evaluation | End Semester Examinations |
|---|---|---|---|---|
| CO-1 | ✓ | ✓ | - | ✓ |
| CO-2 | ✓ | - | - | ✓ |
| CO-3 | ✓ | ✓ | - | ✓ |
| CO-4 | ✓ | ✓ | - | - |
| CO-5 | ✓ | ✓ | - | ✓ |