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| Program : Diploma in Biomedical Engineering | |
| Course Code : 4242 | Course Title: Therapeutic Equipment |
| Semester : 4 | Credits: 4 |
| Course Category: Program Core | |
| Periods per week: 4 (L:3, T:1, P:0) | Periods per semester: 60 |

Course Objectives:

To develop the skill to diagnose and rectify the electric circuit networks and understand the operations of electrical machines.

Course Prerequisites:

| Topic | Course code | Course name | Semester |
|--|-------------|------------------------|----------|
| Basic Engineering Mathematics principles | | Mathematics I & II | 1 & 2 |
| Magnetism | | Applied Physics I & II | 1 & 2 |

Course Outcomes:

On completion of the course, the student will be able to:

| CO _n | Description | Duration (Hours) | Cognitive Level |
|-----------------|---|------------------|-----------------|
| CO1 | Solve a given AC circuit to find various parameters | 11 | Applying |
| CO2 | Apply various network theorems for simplifying electric circuits and networks and illustrate the operations of transformers | 12 | Applying |
| CO3 | Illustrate the principles and operations of DC machines | 10 | Understanding |
| CO4 | Illustrate the principles and operations of AC machines | 10 | Understanding |
| | Series test | 2 | |

CO – PO Mapping:

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|-----------------|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3 | | | | | | |
| CO2 | 3 | | | | | | |
| CO3 | 2 | | | | | | |
| CO4 | 2 | | | | | | |

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

Course Outline:

| Module Outcomes | Description | Duration (Hours) | Cognitive Level |
|--|---|------------------|-----------------|
| CO1 | Solve a given AC circuit to find various parameters | | |
| M1.01 | Illustrate the concept of AC signals | 1 | Understanding |
| M1.02 | Explain the behavior of AC through R-L-C components | 2 | Understanding |
| M1.03 | Solve the power in given AC circuits by keeping the concept of phasor diagram. | 4 | Applying |
| M1.04 | Solve given series and parallel RLC circuits and find the various parameters. | 4 | Applying |
| Contents: Concept of alternating voltage and current - Different waveforms (Sine, Square, Triangular and Sawtooth) - representation of alternating quantities - define the terms cycle, time period, frequency, amplitude, phase, maximum value, rms value, average value form factor AC through resistance, inductance, and capacitance (Solve simple problems) - Phasor diagrams - power factor definition - calculation of active, reactive and apparent power, Resonance and Q factor in an RLC circuit - series and parallel AC circuits (simple problems). | | | |
| CO2 | Apply various network theorems for simplifying electric circuits and networks and illustrate the operations of transformers. | | |
| M2.01 | Illustrate various network theorems | 3 | Understanding |
| M2.02 | Apply various network theorems for solving electrical and electronics circuits. | 4 | Applying |
| M2.03 | Explain principle and operations of various transformers | 3 | Understanding |
| M2.04 | List the types and applications of Transformers. | 2 | Remembering |
| | Series Test – I | 1 | |

Contents:**Network Theorems and Transformers**

Ohm's law - Kirchhoff's law- Superposition theorem - Thevenin's theorem - Maximum power transfer theorem (Solve simple problems)

Transformers: working principle of transformer - construction of transformer - elementary theory of an ideal transformer - voltage transformation ratio and rating of a transformer - emf equation derivation - losses in transformers - types, applications of transformers

| CO3 | Illustrate the principle and operations of DC machines | | |
|------------|---|---|---------------|
| M3.01 | Explain the principle and operation of a DC generator. | 3 | Understanding |
| M3.02 | Explain the principle and operation of a DC motor. | 2 | Understanding |
| M3.03 | Illustrate the use of starter in DC Motors. | 3 | Understanding |
| M3.04 | Compare different DC motors | 2 | Understanding |

Contents:**DC Machines**

Working principle of DC generator - different types of DC generators - emf equation of a DC generator - armature reaction - no load characteristics - types.

DC motors - working principle of DC motor - significance of back emf in DC motor - starters - Types of starters -necessity of starter in DC motor - 3 point starter - comparison of DC motors with characteristics and speed

| CO4 | Illustrate the principle and operations of AC machines. | | |
|------------|--|---|---------------|
| M4.01 | Explain the principles and operations of alternator | 2 | Understanding |
| M4.02 | Explain the principle and operations of AC motor | 2 | Understanding |
| M4.03 | List the applications of various AC motors. | 3 | Understanding |
| M4.04 | Explain the principle of three phase motors. | 3 | Understanding |
| | Series Test – II | 1 | |

Contents:**AC Machines**

Alternators - working principle of an alternator- emf equation of an alternator - synchronous speed and frequency - the open circuit characteristics of an alternator

AC motors - working principle and classification of AC motors - working principle and applications of stepper motor, universal motor, servo motor - working principle and applications of single phase and three phase induction motor

Text / Reference:

| T/R | Book Title/Author |
|------------|--|
| T1 | B. L. Thereja and A. K. Thereja, “Textbook of Electrical Technology: Part 1 - Basic Electrical Engineering in S. I. Units”, S. Chand Publication, 2012 |
| R1 | B. L. Thereja and A. K. Thereja, “Textbook of Electrical Technology: Part 2–AC and DC machines”, S. Chand Publication, 2012 |
| R2 | Dr Ganesh Rao& R Sreenivasa, “Network Analysis : A simplified approach”, Cengage |
| R3 | J.B Guptha, “Fundamentals of Electrical Engineering& Electronics”, S. K. Kataria& Sons, 2009 |

Online Resources:

| Sl.No | Website Link |
|--------------|---|
| 1 | https://www.khanacademy.org/electrical/ |
| 2 | https://ocw.mit.edu/electrical |
| 3 | www.swayam.gov.in |