Subjects for Minor Degree							
Electrical Engineering							
SWAYAM/NPTEL Course List							
Sr. No.	**Semester**	**Name of Course**	**Teaching Scheme**	**Duration**	**Instructor**	**Organizing Institute**	**Credits**
1	V	Fundamentals of Electrical Engineering	4Hrs/week	12 Weeks	Prof. Debapriya Das	IIT Kharagpur	4
2	V	Basic Electrical Circuits	4Hrs/week	12 Weeks	Prof. Ngendra Krishnapura	IIT Madras	4
3	VI	Control Engineering	4Hrs/week	12 Weeks	Prof. Ramkrishna. P.	IIT Madras	4
4	VI	Power System Engineering	4Hrs/week	12 Weeks	Prof. Debapriya Das	IIT Kharagpur	4
5	VII	Electrical Machines- I	4Hrs/week	12 Weeks	Prof. Tapas Kumar Bhattacharya	IIT Kharagpur	4

NPTEL courses for Minor

Course Contents

1. Fundamentals of Electrical Engineering

Number of weeks: 12

Week 1: Basic Concepts and Basic Laws

Week 2: Methods of Analysis

Week 3: DC Network Theorems

Week 4: Capacitors and Inductors and First Order Circuits

Week 5: Sinusoidal and Phasors

Week 6: Sinusoidal Steady-State Analysis

Week 7: AC Circuit Analysis and Network Theorems

Week 8: Series and Parallel Resonance and Magnetically Coupled Circuits.

Week 9: Three Phase Circuits and Power Measurements

Week 10: Single Phase Transformers

Week 11: Three Phase Induction Machines

Week 12: DC Machines

2. Basic Electrical Circuits

Number of weeks: 12

Week 1: Preliminaries; Current and voltage; Electrical elements and circuits; Kirchhoff's laws, Basic elements: Voltage and current sources, R, L, C, M; Linearity of elements

Week 2: Elements in series and parallel, controlled sources

Week 3: Power and energy in electrical elements, Circuit Analysis Methods

Week 4: Nodal analysis, extending nodal analysis with different sources

Week 5: Mesh analysis, Circuit theorems

Week 6: More circuit theorems, Two port parameters

Week 7: Two port parameters continued, Reciprocity in resistive networks

Week 8: Opamp and negative feedback, Opamps cont'd: Example circuits and additional topics

Week 9: First Order Circuits, First Order Circuits cont'd

Week 10: First order circuits with time-varying inputs, Sinusoidal steady state response and total Response.

Week 11: Second order system-Natural response, Second order system-Cont'd

Week 12: Direct calculation of steady state response from equivalent components, Magnitude and Phase plots; Maximum power transfer theorem.

3. Control Engineering

Number of weeks: 12

Week 1: Mathematical Modelling of Systems

Week 2: Laplace Transforms, transfer functions, block diagram representation.

Week 3: Block diagram reduction, Time response characteristics.

Week 4: Introduction to stability, Routh Hurwitz stability criterion.

Week 5: Root locus plots, stability margins.

Week 6: Frequency response analysis: Nyquist stability criterion, Bode plots and stability margins in frequency domain.

Week 7: Basics of control design, the proportional, derivative and integral actions.

Week 8: Design using Root Locus

Week 9: Design using Bode plots

Week 10: Effects of zeros, minimum and non-minimum phase systems.

Week 11: State space analysis

Week 12: Design using State space

4. Power System Engineering

Number of weeks: 12

Week 1: Overhead Line Insulators

Week 2: Underground Cables

Week 3: Transient Over-voltages and Insulation Coordination

Week 4: Corona

Week 5: Sag and Tension

Week 6: Distribution System Load Flow and Voltage Stability

Week 7: Approximate Method of Distribution System Analysis

Week 8: Application of Capacitors for Radial Distribution Systems

Week 9: Load Frequency Control

Week 10: Load Frequency Control

Week 11: Unit commitment

Week 12: Unit Commitment

5. Electrical Machines – I

Number of weeks: 12

Week 1: Single phase Ideal transformer and basic equations. It's equivalent circuit.

Week 2: Core loss: Eddy current and hysteresis loss – factors on which it depends.

Week 3: Taking Leakage flux, winding resistances and core loss in the equivalent circuit of the transformer.

Week 4: Exact and approximate equivalent circuit, Phasor diagram, Regulation & efficiency.

Week 5: Open circuit and short circuit tests, Estimation of equivalent circuit parameters.

Week 6: Three phase transformer and various connections with vector groups.

Week 7: DC machine constructional features and basic idea of its operation, Armature winding, Commutator segments and brushes.

Week 8: Lap and wave windings and number of parallel paths in armature circuit. Emf equation.

Week 9: Torque equation. Separately excited and shunt generator characteristics.

Week 10: Armature reaction and its ill effects. How to nullify the effects of armature reaction.

Week 11: Shunt, series and compound motor characteristic.

Week 12: Starting, speed control and braking of DC motor, testing.