

Pokhara University
Faculty of Science and Technology

Course No.: xxx xxx

Course title: Basic Electrical Engineering (3-1-2)

Nature of the course: Theory & Practical

Level: Undergraduate

Full marks: 100

Pass marks: 45

Time per period: 1 hour

Total Periods: 45

Program: BE Computer/
BEIT

1. Course Description

This course covers the various concepts of electrical circuits, theorems as well as the concepts of electrical machines. This course emphasizes on fundamental concept, principles and properties of electrical circuits, circuit parameters and its application. It also covers the concepts of DC and AC electrical circuit analysis and electrical machine.

2. General Objective

The general objectives of this course are:

- To acquaint the students with AC and DC electric circuits, steady state behavior of single phase and three phase AC electrical circuits.
- To make the students able to distinguish and use electrical devices and machines.

3. Methods of Instruction

Lecture, Discussion, Readings, Lab works, Project works

4. Contents in Detail

Specific Objectives	Contents
<ul style="list-style-type: none">Describe the generation, transmission, distribution and use of electrical energy.	Unit I: Introduction (2 hrs) <ol style="list-style-type: none">Role of electricity in modern society,Energy sources and production,Generation, transmission and distribution of electrical energy,Consumption of electricity
<ul style="list-style-type: none">Evaluate voltages and currents across the electric circuits using voltage and current divider rule.Use Kirchhoff's laws to evaluate current and voltage in DC circuits.Obtain the equations for DC electric circuits using mesh and nodal analyses and solve them to evaluate current(s)/voltage(s).Explain and use network theorems to reduce a DC circuit to a simple equivalent.	Unit II: DC Circuit Analysis (15 hrs) <ol style="list-style-type: none">Circuits concepts (lumped and distributed parameters), linear and nonlinear parameter, passive and active circuits,Circuit elements (Resistance, capacitance and inductance), their properties and characteristics in a geometrical and hardware aspects,Color coding, Series of parallel compilation of resistances, Equivalent resistance and its calculation, star-delta transformation,Concept of power, energy and its calculations,Short and open circuit,Ideal and non-ideal sources, source conversion,

	7. Voltage divider and current divider formula, 8. Kirchhoff's current and voltage laws, 9. Nodal method and mesh method of network analysis (without dependent source), 10. Network theorem (Superposition, Thevenin's, Norton's, maximum power transfer theorem)
<ul style="list-style-type: none"> Explain generation of single-phase alternating quantities and its characteristics. Calculate average and root-mean-square values of alternating voltage(s)/current(s). Analyze the steady state behavior of single-phase AC electric circuits. 	Unit III: Single Phase AC Circuits Analysis (10 hrs) <ol style="list-style-type: none"> Generation of EMF by electromagnetic induction, Generation of alternating voltage, Sinusoidal functions-terminology (phase, phase angle, amplitude, frequency, peak to peak value), average values and RMS or effective value of any types of alternating voltage or current waveform, Phase algebra, power triangle, impedance triangle, steady state response of circuits (RL, RC, RLC series and parallel) and concept about admittance, impedance, reactance and its triangle), instantaneous power, average real power, reactive power, power factor and significance of power factor, Resonance in series and parallel RLC circuit, bandwidth, effect of Q factor in resource
<ul style="list-style-type: none"> Explain generation of poly phase alternating quantities and its characteristics. Analyze the steady state behavior of three phase AC electric circuits. Describe the measurement of three phase power. 	Unit IV: Poly-phase AC Circuit Analysis (6 hrs) <ol style="list-style-type: none"> Generation of three phase alternating quantity and Concept of a balanced three phase supply, Differences between single phase and three phase system, Star and delta connected supply and load circuits., Line and phase voltage/current relations, power measurement, Concept of three phase power and its measurement by single and two wattmeter methods
<ul style="list-style-type: none"> Analyze the difference between electric and magnetic circuits. Explain the working principle of single-phase two-winding transformer. Analyze open circuit and short circuit tests of single-phase two-winding transformer. Explain the performance and operation of DC machines 	Unit V: Electrical Machines (12 hrs) <ol style="list-style-type: none"> Differences and similarities between electric circuit and magnetic circuit Transformers: Principle of operations, features, equivalent circuits, efficiency & regulation, open circuit & short circuit tests of single phase two winding transformer. DC generator: Construction features, working principles, basic characteristics DC motors: Performance & operation, basic characteristics, speed control & selection of motors AC machines: Single phase and three phase

<ul style="list-style-type: none"> Explain the construction, working principle and use of induction motors. 	induction motors (working principles, construction features and uses)
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5. Laboratory Works

- To measure current, voltage and power across the passive components.
- To verify Kirchhoff's Current Law (KCL) & Kirchhoff's Voltage Law (KVL)
- To verify Thevenin's Theorem.
- To verify maximum power transfer theorem.
- To verify superposition theorem.
- To measure three phase power by using two wattmeter
- To determine efficiency and voltage regulation of a single-phase transformer by direct loading.
- To study open circuits & short circuits tests on a single-phase transformer
- To study the speed control of dc shunt motor by.
 - Varying the field current with armature voltage held constant field control.
 - Varying the armature voltage with field current held constant armature control.
- To study open circuits and load test on a dc shunt generator (separately excited)
 - To determine magnetization characteristics
 - To determine V-I characteristics of a dc shunt generator

6. List of Tutorials

The various tutorial activities that suits your course should cover all the content of the course to give students a space to engage more actively with the course content in the presence of Instructor/professor. The following tutorial activities of 15 hrs. should be conducted to cover the content of this course:

- Discussion-based Tutorials: (1 hr)
- Numerical discussion on DC circuit analysis (star/delta conversion, mesh analysis, nodal analysis, superposition theorem, Thevenin's theorem, Norton's theorem and Maximum power transfer theorem. (5 hrs)
- Numerical discussion on single phase ac circuit (3 hrs)
- Analysis and numerical solution of three phase ac circuits. (2 hrs)
- Numerical problems discussion on single phase Transformer, dc motor, dc generator. (4 hrs)

7. Evaluation system and Students' Responsibilities

Evaluation System

The internal evaluation of a student may consist of assignments, attendance, term-exams, lab reports and projects etc. The tabular presentation of the internal evaluation is as follows:

External Evaluation	Marks	Internal Evaluation	Weight	Marks
Semester-End examination	50	Theory		30
		Attendance and Class Participation	10%	
		Assignments	20%	
		Presentations/Quizzes	10%	
		Term exam	60%	
		Practical		20

		Attendance and Class Participation	10%	
		Lab Report/ Project Report	20%	
		Practical Exam/ Project Work	40%	
		Viva	30%	
		Total Internal		50
Full Marks: 50 + 50 = 100				

Student Responsibilities

Each student must secure at least 45% marks in internal evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) and the student will not be eligible to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

8. Prescribed Books and References

Text Books

1. Boylested, Albert "Introduction of Electric circuit" Prentice Hall of India Private Limited, New Delhi
2. Thereja B. L & Thereja A. K. "A text book of Electrical Technology, S Chand Publication.

References

1. Jain & Jain "ABC of Electrical Engineering"
2. Tiwari, S.N, "A first course of electrical engineering" att. Wheeler & Co. Ltd. Allabhad.