Pokhara University
Faculty of Science and Technology

Course No.: xxx xxx	Full marks: 100
Course title: Basic Electrical Engineering (3-1-2)	Pass marks: 45
Nature of the course: Theory & Practical	Time per period: 1 hour
Level: Undergraduate	Total Periods: 45
	Program: BE

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 electric circuits (A.C. & D. C), steady state behavior of single phase and three phase A.C. electrical circuits.
- To make the students able to operate, 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
• Describe about the generation, transmission, distribution and use of electrical energy	**Unit I: Introduction (2 hrs)** 1. Role of electricity in modern society, 2. Energy sources and production, 3. Generation, transmission and distribution of electrical energy, 4. Consumption of electricity
• Apply basic rules and theorem in circuit analysis	**Unit II: DC Circuit Analysis (15 hrs)** 1. Circuits concepts (lumped and distributed parameters), linear and nonlinear parameter, passive and active circuits, 2. Circuit elements (Resistance, capacitance and inductance), their properties and characteristics in a geometrical and hardware aspects, 3. Color coding, Series of parallel compilation of resistances, Equivalent resistance and its calculation, star-delta transformation, 4. Concept of power, energy and its calculations, 5. Short and open circuit, 6. 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)
• Analyze generation of single-phase alternating quantities and its characteristics • Analyze the steady state behavior of single-phase ac electrical circuits	**Unit III: Single Phase AC Circuits Analysis (10 hrs)** 1. Generation of EMF by electromagnetic induction, Generation of alternating voltage, 2. 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, 3. 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, 4. Resonance in series and parallel RLC circuit, bandwidth, effect of Q factor in resource
• Analyze generation of poly phase alternating quantities and its characteristics • Analyze the steady state behavior of three phase ac electrical circuits. • Describe the measurement of three phase power	**Unit IV: Poly-phase AC Circuit Analysis (6 hrs)** 1. Generation of three phase alternating quantity and Concept of a balanced three phase supply, 2. Differences between single phase and three phase system, 3. Star and delta connected supply and load circuits., Line and phase voltage/current relations, power measurement, 4. Concept of three phase power and its measurement by single and two wattmeter methods
• Analyze performance and operation of single phase two winding transformer • Analyze performance and operation of DC machine • Analyze performance and operation of some AC machines	**Unit V: Electrical Machines (12 hrs)** 1. Differences and similarities between electric circuit and magnetic circuit 2. Transformers: Principle of operations, features, equivalent circuits, efficiency & regulation, open circuit & short circuit tests of single phase two winding transformer. 3. DC generator: Construction features, working principles, basic characteristics 4. DC motors: Performance & operation, basic characteristics, speed control & selection of motors 5. AC machines: Single phase and three phase induction motors (working principles, construction features and uses)

5. Laboratory Work

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

1. Discussion-based Tutorials: (1 hr)
2. 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)
3. Numerical discussion on single phase ac circuit (3 hrs)
4. Analysis and numerical solution of three phase ac circuits. (2 hrs)
5. 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 & Class Participation	10%	
		Assignments	20%	
		Presentations/Quizzes	10%	
		Term exam	60%	
		Practical		20
		Attendance & Class Participation	10%	
		Project Report	10%	
		Viva	20%	

		Exam	60%	
		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. Tiwari, S.N, "A first course of electrical engineering" att. Wheeler & Co. Ltd. Allabhad.

References

1. Thereja B. L & Thereja A. K. "A text book of Electrical Technology, S Chand Publication.
2. Jain& Jain "ABC of Electrical Engineering"