GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: ELECTRICAL NETWORK AND CIRCUITS
(Code: 3342403)

Diploma Programme in which this course is offered	Semester in which offered
Power Electronics	4th Semester

1. RATIONALE

This course is intended to enable the student understand the facts, concepts and principles of the electrical engineering network and circuits and methods to analyse them, which will enable him/her in designing, operating and maintaining electric circuits. This course is therefore a key course for every power electronics engineer.

2. COMPETENCY

The course content should be taught and curriculum should be implemented with the aim to develop required skills in students so that they are able to acquire following competency:

- **Design, operate and maintain DC and AC Networks using network theorems.**

3. COURSE OUTCOMES (COs)

The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

i. Analyse circuits using Kirchhoff's laws
ii. Interpret the response of different RLC circuits to AC supply.
iii. Analyse networks circuits using mesh, node and source transformation.
iv. Solve networks and mutually coupled circuits using network theorems.
v. Analyse two port network

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
4	1	2	7	70	30	20	30	**150**

Legends: L - Lecture; **T -** Tutorial/Teacher Guided Student Activity; **P -** Practical; **C -** Credit; **ESE** - End Semester Examination; **PA** - Progressive Assessment

5. COURSE DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
UNIT – I **Basic Circuits Elements And Energy Sources**	1a. Differentiate between, electric Current, Potential Difference, Electric Power and Energy	1.1. Electric circuit terminology: Electric Current, Potential Difference, Electric power and Energy
	1b. Calculate voltage and current in R, L and C circuits	1.2. Voltage Drop and Current through: Resister, Capacitor and Inductor
	1c. Calculate equivalent source from series and parallel connected energy sources	1.3. Sources of electrical energy: dependant and independent; Series and parallel connected sources, Source transformation
	1d. Solve various electrical networks applying Ohm's Law, Kirchhoff's laws, Divider Rules etc.	1.4. Ohm's Law 1.5. Kirchhoff's laws: Kirchhoff's current law, Kirchhoff's voltage law 1.6. Divider Rules
	1e. Transform Delta-Wye and Wye – Delta connections	1.7. Delta-Wye Transformation
UNIT – II **Alternating Current Circuits**	2a. Calculate average value, RMS value and form factor of AC circuits	2.1. Alternating Current: average value, RMS value and form factor.
	2b. Interpret the response of R, L, C; RL, RC and RLC series circuits to AC supply. 2c. Explain series and parallel resonance with its quality factor and bandwidth.	2.2. A.C. Voltage applied to: resister, inductor, capacitor, RL, RC and RLC series circuits. 2.3. Series and parallel resonance, Quality factor, Bandwidth
	2d. Solve problems to Convert AC voltage and current to polar, rectangular and vector form.	2.4. Alternating current and Voltages: Polar form, Rectangular form and Vector representation.
UNIT – III **Network Analysis**	3a. Analyse networks using mesh and nodal analysis 3b. Apply source transformation in relevant applications	3.1. Mesh analysis, Nodal analysis 3.2. Source Transformation
UNIT – IV **Network Theorems And Coupled Circuits**	4a. State the salient features of the various network theorems 4b. Apply various network theorems to analyse various types of DC circuits	4.1. Network Theorems: Thevenin's, Norton's, Superposition, Maximum power transfer, Millman's, Reciprocity Tellegen's and Compensation Theorems.
	4c. Describe the features of mutually coupled series and parallel circuits 5a. Explain the working of conductively coupled equivalent circuits 4d. State the need for dot convention	4.2. Mutually coupled circuits- series and parallel connection, Conductively coupled equivalent circuits 4.3. Dot convention
UNIT – V	5a. Explain the need for two port network	5.1. Network parameter: two port; Relationship between parameters

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Two Port Network	5b. Explain the relationship between network parameters	
	5c. Describe series and cascade interconnection of two port network.	5.2. Interconnection: series, cascade

6. SUGGESTED SPECIFICATION TABLE WITH HOURS and MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basic circuits elements and energy sources	12	3	7	5	15
II	Alternating Current Circuits	9	2	6	3	11
III	Network Analysis Techniques	10	0	4	8	12
IV	Network Theorems and Coupled Circuits	18	8	7	8	23
V	Two port network	7	0	5	4	9
Total Hrs		**56**	**13**	**29**	**28**	**70**

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills **(outcomes in psychomotor and affective domain)** so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes (**as given in a common list at the beginning of curriculum document for this programme) would be assured.*
Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical/Exercise (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
1.	I	Use C.R.O. to analyse waveforms.	4
2.	I	Use Kirchhoff's Current Law in electric/electronic circuits	2
3.	I	Use Kirchhoff's Voltage Law in electric/electronic circuits	2
4.	I	Use Current divider rule in circuits	2
5.	I	Use Voltage divider rule in circuits	2

S. No.	Unit No.	Practical/Exercise (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
6.	I	Use line and phase values of voltage and current in star connected balanced load situation.	2
7.	I	Use line and phase values of voltage and Current in delta connected balanced load situation.	2
8.	II	Obtain the phasor diagram of R-L, R-C, R-L-C series circuit.	4
9.	III	Analyse circuits using Nodal analysis.	4
10.	III	Analyse circuits using Mesh analysis.	4
11.	III	Analyse circuits using Source Transformation.	2
12.	IV	Use superposition theorem to analyse D. C. circuit.	2
13.	IV	Use Thevenin's theorem to analyse D. C. circuit	2
14.	IV	Use Norton's theorem to analyse D. C. circuit	2
15.	IV	Use maximum power transfer Theorem to analyse D.C. circuit.	2
16.	IV	Analyse Series and Parallel connection of Mutually coupled circuit.	2
17.	V	Determine relation between two-port parameters.	2
Total Hrs (perform practical worth 28 hours so that most units are covered)			**42**

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities such as:

i. Prepare process chart of Mess and Nodal analysis.
ii. Prepare process chart of different Network Theorems for DC circuits.
iii. Prepare working model of star-delta conversion and vice-versa.

9. SPECIAL INSTRUCTIONAL STRATEGY (If Any)

Give numerical problems to students for solving during tutorial classes, and help them whenever they need it.

10. SUGGESTED LEARNING RESOURCES

A) List of Books

S. No.	Title of Books	Author	Publication
1	Electrical Networks and Circuits	Manke B.S.	Khanna publishers, New Delhi, latest edition
2	Electrical Circuit analysis	P.Ramesh babu	Scitech, New Delhi, latest edition

B) List of Major Equipment/Materials with Broad Specifications

i. Variable transformer.(0-230 volt, 6 amp)
ii. Three phase transformer. (100 kva , 410v)
iii. Single phase transformer.(primary-120/240, secondary-120,140,160)
iv. Rheostat(various)
v. DSO

vi. Variable D.C. Power supply.(0-30v)
vii. RLC DC Circuit trainer board.
viii. Multimeter.

C) List of Software/Learning Websites

i. http://www.electrical4u.com/
ii. https://www.math.ucdavis.edu/~daddel/linear_algebra_appl/Applications/Electrical_Circuits/Electrical_Circuits.html
iii. http://electricalengineeringforbeginners.blogspot.in/2011/06/network analysis-for-electric-circuits.html
iv. www.youtube.com
v. www.nptel.iitm.ac.in
vi. http://en.wikipedia.org/wiki/Network_analysis_%28electrical_circuits %29

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. S. L. Dhoriyani**, LPE, Dept. of Power Electronics, Dr. S. and S. S. Ghandhy College of Engg. and Technology, Surat.
- **Prof (Smt.) J. M. Patel**, ALPE, Dept. of Power Electronics, Dr. S. and S. S. Ghandhy College of Engg. and Technology, Surat.

Coordinator and Faculty Members from NITTTR Bhopal

- **Prof. A. S. Walkey,** Associate Professor, Department of Electrical and Electronics Engineering
- **Prof. Joshua Earnest,** Professor, Department of Electrical and Electronics Engineering