

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

Course Title: Electronics Workshop
(Code: 3321103)

Diploma Programmes in which this course is offered	Semester in which offered
Electronics & Communication Engineering	Second Semester

1. RATIONALE

Students have learned about different electronic components and devices in ‘Electronic Components and Practice’ course in the First semester. This course of ‘Electronics Workshop Practice’ is aimed to provide the students with more hands-on experience and also enable them to develop and test simple PCB circuits. Selection of components, wiring, soldering, desoldering, testing and troubleshooting, are some of the basic skills required by industry from any electronics engineering diploma holder. Students also need to develop enough learning confidence to complete entire project work related to various courses in subsequent higher level semesters. Hence, this course is designed to develop these vital skills required by the electronic industry through various laboratory experiences and strategies like mini-projects.

2. COMPETENCY

The course content should be implemented with the aim to develop different types of skills leading to the achievement of the following competency:

- **Test self-built electronic circuits comprising of discrete electronic components.**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	100
0	0	4	4	0	0	40	60	

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit ESE - End Semester Examination; PA - Progressive Assessment.

Note: It is the responsibility of the institute heads that marks for **PA of theory & ESE and PA of practical** for each student are entered online into the GTU Portal at the end of each semester within the dates specified by GTU.

4. DETAILED COURSE CONTENT

Unit	Major Practical Learning Outcomes	Topics and Sub-topics
Unit – I Electronic Components, Measuring Instruments and Tools	1a. Identify a particular component from the given group of passive electronic components	1.1 Passive components: Different types of: resistors, inductors, capacitors, potentiometers, Thermistor, Transformer, auto transformer
	1b. Identify the terminals of active electronic components .	1.2 Active components: Diode, Zener diode, Varactor diode, LED, Photo diode, BJT, Photo transistor, FET, LDR, Solar cell, Photocell, Opto-coupler
	1c. Use voltage source. 1d. Use test and measuring instruments.	1.3 Voltage Sources: DC battery (Pencil cell :1.5V, AAA, AA Type, +9V, Rechargeble Cell, Mobile battery) AC power supply, DC power supply 1.4 Measuring Instruments: Different types of Voltmeters, Ammeters, Watt meters, multimeter, LCR-Q meter, CRO, DSO, Function Generator, Frequency counter
	1d. Use electronic workshop tools for building and wiring electronic circuits with necessary safety	1.5 Electronic Workshop Tools: Bread board, Copper clad laminate sheet, Solder iron, solder-stand, solder-wire, flux, flexible wire, hookup wire, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, de-solder pump, De-solder wick, drilling machine
Unit– II Building, Wiring, Soldering and Testing of Electronic Circuits	2a. Sketch the standard symbols of various active and passive electronic components 2b. Draw the electronic circuits using standard symbols	2.1 Electronic circuit Drawing <ul style="list-style-type: none"> • Series and Parallel network using Resistors, Capacitors, T-type/ π-type attenuator, • Circuit diagram for: <ul style="list-style-type: none"> - forward/reverse biased PN Junction diode - Half wave, Full wave and Bridge Rectifier using diode - characteristics of Zener diode/ LED/ Photo diode/LDR - Transistor characteristics in CE/CB configuration - Zener diode as shunt regulator - Transistorized shunt/ series regulators - +5V, -5V, +/-5V dc regulated power supply using IC 78XX / 79XX with

Unit	Major Practical Learning Outcomes	Topics and Sub-topics
		LED indication - LM317 variable voltage regulator - Clipper/Clamper - Low pass filter, High pass filter, Band pass filter, Band elimination filter - Light operated Relay - Transistorized touch control switch - Rain drop detector
	2b. Build/test and troubleshoot electronic circuits on breadboard 2c. Build/test electronic circuits on general purpose PCB	2.2 Electronic circuit on bread board 2.3 Soldering/desoldering, electronic circuit on general purpose PCB
Unit- III Use of Data sheets for Component Selection and Specification	3a. Find the specification of electronic component from data sheet/data manual. 3b. Select appropriate component for given circuit application. 3c. Select specification of Surface Mount Device (SMD) components as required.	3.1 Manufacturer's Datasheet of: - Diodes IN4001 to 07, IN4148; 2N5402, 2N5408, BY127 - Zener Diode, Photo diode, LED, Varactor diode, Seven segment LED - Transistors BC107, BC177, BC547/548, SL100, SK100, AC127/128, BF194, TIP122, Photo transistor - voltage regulator IC78XX, 79XX, LM317 - Packages of various SMD components: Resistor, Capacitor, Inductor, Diode-LL4148, SM4007, Chip transistor, Chip Darlington transistor, Bridge rectifier
Unit – IV Schematic, Layout and Tracing of Electronic Circuits	4a. Create PCB layout manually. 4b. Create schematic and layout of given electronic circuit using any Simple PCB design software. 4c. Trace circuit from given PCB layout on the PCB.	4.1 Manually Prepare PCB layout on graph paper 4.2 PCB design software 4.3 PCB layout - Component side and copper side 4.4 Tracing for PCB Fabrication 4.5 Tracing of circuit on PCB
Unit – V Mini Project	5a. Fabricate PCB & build the given circuit on the PCB. 5b. Test the assembled circuit on PCB. 5c. Prepare project report in proper format.	5.1 Fabrication of PCB, component mounting, Soldering, testing & troubleshooting of circuits on PCB

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
I	Electronic Components, Measuring Instruments and Tools		Not applicable			
II	Building, Wiring, Soldering and Testing of Electronics Circuit					
III	Use of Data sheets for Component Selection and Specification					
IV	Schematic, Layout and Tracing of Electronic Circuits					
V	Mini Project					

Legends: R = Remember; U = Understand; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as only general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table.

6. SUGGESTED LIST OF EXERCISES/PRACTICALS

The practical exercises should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the above mentioned expected competency. In some of the practical exercises from S.No.8 onwards, the identified list is for for guideline only. Other necessary electronic tools, components ,circuits etc. can also be included by considering contents of current semester subjects like 'Electronic Components & Practice' (ECP), 'Electronic Circuits and Applications' (ECA) or 'Electronic Networks' (EN).

S. No.	Unit No.	Practical Exercises	Approx. Hrs Required
1	I & II	Draw symbols of various electronic components on drawing sheets.	02
2	I & II	Draw the circuit diagrams of various (Simple to Complex) electronic circuits on drawing sheets.	04
3	I	Compare the values with the measured by using measuring instruments like Digital Multimeter, LCR-Q Meter: Resistors inductors, capacitors, potentiometers, Trimmers, Thermistor, Transformer, auto transformer.	04
4	I	Identify the terminals of the following components: Diode, Zener diode, Varactor diode, LED, Photo diode, BJT, Photo transistor, FET, LDR, Solar cell, Photocell, Opto-coupler, 7 Segment Display, Relays	02
5	I	Use the following instruments to measure the parameters of any electronic circuit : Function Generator, Frequency counter, CRO, and DSO, with all safety precautions.	02
6	I	Provide some exercises so that the following electronics hardware tools and materials are learned to be used by the students (as a	02

S. No.	Unit No.	Practical Exercises	Approx. Hrs Required
		guideline only): (a) Bread board (b) Copper clad laminate sheet (c) Solder iron, solder-stand (d) Solder-wire, flux (e) Flexible wire (f) Hookup wire (g) Cutter (h) Nose plier (i) Screwdriver set (j) Wire stripper (k) De-solder pump (l) De-solder wick (m) Drilling machine .	
7	II	Sketch, mount and test at least six from following electronic circuit on bread board (Circuits given as a guideline only): (a) T type attenuator (b) π -type attenuator (c) Forward/reverse biased PN Junction diode (d) Zener diode as shunt regulator (e) Opto coupler using LED & Photo diode (f) Half wave Rectifier, Full wave & Bridge rectifier (g) Light operated relay (h) Diode clipper (i) Diode clamper (j) Transistorized series regulator (k) +/- 5V Regulated power supply with LED indication (l) Low pass filter, High pass filter (m) Band pass filter, Band elimination filter (n) Variable power supply using LM317.	06
8	II	Sketch, mount, wire, solder and test at least six from electronic circuits (mentioned in S.No. 9 above) on general purpose board.	06
9	II	De-solder given circuit(s) from general purpose printed circuit board.	02
10	III	Find Specifications and package of following components from Datasheet. (as a guideline only): (a) Diodes IN4001 to 1N4007, IN4148, 2N5402, 2N5408, BY127 (b) Zener Diode - 5V6 (c) Photo diode - BPW10 (d) LED - LED 55 (e) Varactor diode (f) Seven segment LED (g) Transistors BC107, BC177, BC547/548, (h) Transistors SL100, SK100, AC127/128, BF194, TIP122 (i) IC 78XX, 79XX (j) LM317 (k) SMD components: Resistor, Capacitor, Inductor & Diode- LL4148, SM4007, Chip transistor, Chip Darlington transistor, Bridge rectifier.	04
11	4	1.Prepare layout (Manually) of a given circuit on paper. 2.Create schematic and layout of given electronic circuit using any PCB design software:	06

S. No.	Unit No.	Practical Exercises	Approx. Hrs Required
		(a) +/-12V Regulated Power supply Using 7812 & 7912 (b) Light operated Relay (c) TV remote checker using transistor ,IR photo diode, red LED (d) Touch switch using transistor (e) Door safety using Reed and magnet (f) Water level alarm using single transistor (g) Opaque Object sensing alarm using LDR, transistor & Buzzer	
12	IV	Trace electronic circuit from the given PCB layout of an electronic circuit.	02
13	V	Mini project 1 Create schematic, layout and fabricate PCB for given electronic circuit and prepare brief report on it.	06
14	V	Mini project 2 Build experiment board (at least one) from following on Hylem sheet and wooden casing in group of five students maximum. (as a guideline only): a) PN junction diode characteristics b) Zener diode characteristics c) LED characteristics d) Half wave, full wave, bridge rectifiers e) Transistor characteristics f) LDR characteristics g) +/-5V dc regulated power supply using LM7805 &LM7905.	06
15	V	Mini project 3 Build extension board with four 5-pin socket, four switches, fuse and indicating lamp. (This is for guideline only; faculty can allot other required electrical wiring related project).	04
Total			58

7. SUGGESTED LIST OF STUDENT ACTIVITIES

- Prepare charts related to the first year electronic courses in a group of maximum 3 students.
- Develop at least two mini projects and their brief report
- Explore at least one circuit using diodes and transistors from internet
- Search the data sheet on web for the given component as literature survey
- Prepare Presentation (PPT) on their project work or on any advanced topic.
- Prepare budget for electrical wiring/system for any given house.

8. SUGGESTED LEARNING RESOURCES

A. List of Books

S. No.	Title of Book	Author	Publication
1	Printed Circuit Boards: Design and Technology	Bossart	TMH, 2008 or latest edition
2	Build Your Own Printed Circuit Board	Al Williams	Mc GrawHill, 2003 or latest edition

S. No.	Title of Book	Author	Publication
3	Making Printed Circuit Boards	Jan Axelsen	Mc GrawHill, 1993 or latest edition
4	Modern World Transistor Data & Its Equivalent	Lotia, M.	B P B, 2008
5	Zener Diodes & Their Application	Mishra, T.R	B P B, 2003
6	Electronic Formulas, Tables Symbols	Sharma, M.C	B P B, 2008
7	Everyday Electronics Data Book	Mike Tooley	B P B, 2011
8	Hobby Electronics Project Special	BPB	B P B, 2011

B. List of Major Equipment/ Instrument:

- i. Multimeter, CRO, DC Power supply, Function generator, LCR –Q meter.
- ii. Drilling Machine with drill bits
- iii. Solder iron, Solder-stand, De-soldering pump
- iv. Cutter, Nose plier, screw driver set, Wire stipper, Desolder wick, Flux, Solder wire, Hook up wire, Flexible wire, Hylem board
- v. Bread board, General purpose Copper clad laminate sheet

C. List of Software/Learning Websites

- i. <http://eecs.vanderbilt.edu/courses/ee213/Breadboard.htm>
- ii. <http://eecs.vanderbilt.edu/courses/ee213/Breadboard.htm>
- iii. <http://wiring.org.co/learning/tutorials/breadboard/index.html>
- iv. <http://www.kpsec.freeuk.com>
- v. <http://courses.engr.illinois.edu/ece343/breadboard.htm>
- vi. <http://library.thinkquest.org/16497/projects/index.html>
- vii. <http://www.technologystudent.com/elec1/tranbrd1.htm>
- viii. <http://circuiteasy.com/>
- ix. www.expresspcb.com/expresspcbhtm/download.htm
- x. www.freepcb.com/
- xi. <http://www.circuitstoday.com/simple-electronics-projects-and-circuits>
- xii. <http://www.buildcircuit.com/5-beginners-projects-that-work-in-the-first-attempt/>

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. S. J. Chauhan**, HOD (EC) , Government Polytechnic, Rajkot
- **Prof. T. P. Chanpura**, Lecturer EC, Government Polytechnic, Ahmedabad
- **Prof. S. G. Valvi**, Lecturer EC, Government Polytechnic, Palanpur
- **Prof. J. A. Patel**, Lecturer EC, Vallabh Buddhi Polytechnic, Navsari

Coordinator & Faculty Members from NITTTR Bhopal

- **Dr. Joshua Earnest**, Professor and Head, Dept. of Electrical and Electronics Engg.
- **Dr.(Mrs.) Anjali Potnis**, Assistant Professor, Dept. of Electrical and Electronics Engg.