GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester: IV

Course Title: Consumer Electronics & Maintenance
(Course Code: 4341107)

Diploma programmer in which this course is offered	Semester in which offered
Electronics and Communication Engineering	4th Semester

1. RATIONALE:

In developing nations demand of consumer electronic appliances is increasing day by day. This requires large number of technically trained men power in relevant industries. Equipments with electronic circuitry are increasingly being used in all the Industry and maintenance of them is the essential work for the proper functioning of the complete system. Looking towards the need of the country, in-depth knowledge for maintaining various electronics audio-video systems and home appliances is necessary for diploma engineering students. This subject will introduce the students with working principles, block diagram and advance features of consumer electronics appliances, which in-turn will develop skills to diagnosis fault and rectification of that in systematic way. This course will enable the students to develop skills to maintain the basic electronic circuitry used in the equipments, which are employed in Industry and in consumer goods segments.

2. COMPETENCY:

The purpose of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain and troubleshoot various consumer electronic domestic/office appliances.

3. COURSE OUTCOMES (COs):

The practical exercises, the underpinning knowledge and the relevant soft skills associated with the identified competency are to be developed in the student for the achievement of the following COs:

1) Select relevant microphones and loudspeakers.
2) Test working of various colour TV.
3) Describe functionality of various electronic domestic appliances.
4) Describe functionality of various electronic office appliances.
5) Follow standard maintenance procedures to maintain various domestic and office appliances.

4. TEACHING AND EXAMINATION SCHEME:

Teaching scheme (In hours)			Total credits (L+T+P/2)	Examination scheme				
				Theory marks		Practical marks		Total marks
L	T	P	C	CA	ESE	CA	ESE	
3	0	2	4	30*	70	25	25	150

(*): Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of the COs.

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

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*.

5. SUGGESTED PRACTICAL EXERCISES:

Following practical outcomes (PrOs) are the sub-components of the Course Outcomes (Cos). Some of the PrOs marked '*' are compulsory, as they are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.

Sr No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Measure audio intensity level with the help of suitable audio level meter.	1	2*
2	Build Test 2 channel audio power amplifiers.	1	2
3	Build Test sound mixer circuit.	1	2
4	Operate digital TV trailer kit and observe wave form.	2	2*
5	Verify the performance of LED TVs. Compare performance parameters of at least three brands.	2	2
6	Install and verify the performance Direct to Home (DTH) receiver.	2	2*
7	Test various functions of microwave oven.	3	2
8	Explore the various functions of automatic washing machine and locate various electronic sensors used in that washing machine.	3	2*
9	Check the wiring of Air Conditioner and explore all the functions.	3	2*
10	Build solar powered DC power supply and verify its performance.	3	2*
11	Demonstrate installation of solar power system and verify its performance.	3	2*
12	Demonstrate installation of CCTV camera system and verify its performance.	4	2
13	Draw the regulated power supply circuit and test voltage at various points of SMPS of any digital television, microwave oven, refrigerator, air-conditioner, MF printer, projector, photo copier etc.	2,3,4	2*
14	Installation of MF printer and test various functions of printer.	4	2
15	Installation of any LCD/LED projector and test its various function.	4	2

16	Test the performance of different active and passive electronic components separately and mounted on PCB.	5	4
17	Demonstrate the steps of maintenance and troubleshooting of any domestic / office appliance.	5	2*

Note:

*i. More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills / outcomes to match the COs. The above table is only a suggestive list.*

The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.

Sr no	Sample Performance Indicators for the PrOs	Weightage in %
1	Prepare of experimental setup	20
2	Operate the equipment setup or circuit	20
3	Follow safety measures and practices	30
4	Record observations correctly	15
5	Interpret the result and conclude	15

6. MAJOR EQUIPMENTS/ INSTRUMENTS REQUIRED:

These major equipments with broad specifications for the PrOs is a guide to procure them by the administrators to user in uniformity of practical's in all institutions across the state.

Sr No.	Equipment Name with Broad Specifications	PrO. No.
1	CRO (Analog/DSO, 100Mhz)	1 to 5
2	Multimeter (Analog/ Digital, 3 and 1/2 digit digital)	1 to 5
3	Audio level meter	1
4	DB Meter	1
5	Microphone of Different Types	1
6	Loudspeaker	1
7	Neon tester 500 V	4
8	Signal Generator, 0-100 KHz	5
9	LCR meter (Digital)	5
10	Clip on ammeter	5
11	Continuity tester	5
12	Digital and Analog IC Tester	5
13	Soldering and De-soldering Station	5
14	Soldering iron 25 W, 240 V with solder materials	5
15	Soldering Iron changeable bits 10 W	5
16	De- soldering pump	2, 5
17	Digital TV trainer	5
18	Screw driver set (set of 5)	5

19	Insulated combination pliers 150 mm	5
20	Insulated side cutting pliers 150 mm	5
21	Long nose pliers 150 mm	5
22	Electrician knife	5
23	Tweezers 100 mm	5
24	Crimping tool (pliers)	5
25	Allen key set (set of 9)	5
26	Magnifying lenses 75mm with illumination	5
27	Air Blower (500 Watt)	5

7. AFFECTIVE DOMAIN OUTCOMES:

The following sample Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfill the development of this course competency.

a) Work as a leader/a team member.
b) Follow ethical practices.
c) Follow safety precautions.
d) Realize importance of E-waste management

The ADOs are best developed through the laboratory/field based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i. 'Valuing Level' in 1st year
ii. 'Organization Level' in 2nd year.
iii. 'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY:

The major underpinning theory is given below based on the higher level UOs of Revised Bloom's taxonomy that are formulated for development of the COs and competency. If required, more such UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Major Learning Outcomes	Topics and sub-topics
Unit - I **Audio Systems**	1a Describe the fundamental audio signal characteristics: Sound intensity, Pitch, Fidelity and Loudness 1b Describe operating principles of different types of microphones. 1c Describe operating principles of different types of loud speakers. 1d Explain optical sound recording process. 1e Describe the working of public address (PA) system, home theatre system.	1.1 Basic characteristics of sound signal: level and loudness, pitch, frequency response, fidelity and linearity, Reverberation 1.2 Audio level metering, decibel level in acoustic measurement 1.3 Microphone: working principle, sensitivity, nature of response, directional characteristics, Types of microphone: carbon, condenser, crystal, electrets, tie- clip, wireless 1.4 Loud speaker: working principle, characteristic impedance, watt capacity Types of loud speaker: electrostatic,

		dynamic, permanent magnet etc, woofers and tweeters 1.5 Sound recording: Optical recording, stereophony and multichannel sound, MP3 standard 1.6 Public address (PA) system: Block diagram and operation 1.7 Home theatre sound system, surround sound: Block diagram and operation.
Unit - II Television Systems	2a Differentiate between hue, brightness, saturation, luminance and chrominance, Colour TV standards 2b Describe functioning of colour TV receiver with the help of block diagram. 2c Describe the function of given section of PAL-D decoder. 2d Explain working of digital TV. 2e Describe the functioning of Direct to Home (DTH) receiver.	2.1 Colour TV standards, colour theory, hue, brightness, saturation, luminance and chrominance 2.2 Block diagram and operation of colour TV receiver. 2.3 Operation of PAL-D decoder 2.4 Digital TV: Working with block diagram and technical specifications of LCD TV, LED TV, OLED TV, QLED TV 2.5 Direct to Home (DTH) receiver: working of Direct to Home with block diagram.
Unit - III Domestic Appliances	3a Explain working of Microwave oven and specification. 3b Describe working of Washing machine. 3c Describe the working of Air conditioner and Refrigerator. 3d Describe the working and installation of solar power system with its specification	3.1 Microwave Oven: working of microwave oven with block diagram, single chip controllers, wiring and safety instructions, technical specifications 3.2 Washing Machine semi/fully automatic: working of washing machine with block diagram, wiring diagram, electronic controller for washing machine, technical specifications, fuzzy logic 3.3 Air conditioner and Refrigerators: working of Air conditioner and Refrigerators with block diagram, technical specification. 3.4 Solar power system: working and installation of solar power system with its specification
Unit - IV Office Appliances	4a Describe the working of multi function printer with its specification. 4b Describe the working and installation of CCTV with its specification. 4c Describe the working of LCD/LED projector with its specification.	4.1 MF printer inkjet and laser: working of inkjet and laser printer with block diagram, technical specifications 4.2 CCTV: working with block diagram and installation of CCTV, its specification. 4.3 LCD/LED projector: working of LCD/LED projector with block diagram, its specification.

	4d Describe working of photocopier machine with its specifications.	4.4 Photocopier: working of photocopier with block diagram, technical specification.
Unit – V Maintenance and troubleshooting	5a Describe the types of maintenance. 5b Describe the maintenance and troubleshooting procedure of audio systems. 5c Describe the troubleshooting procedure of typical TV receivers. 5d Describe the maintenance and troubleshooting procedure of home appliances. 5e Describe the troubleshooting procedure of office appliances.	5.1 Maintenance steps and its types. 5.2 Preventive, predictive and breakdown maintenance 5.3 Maintenance and troubleshooting of Audio systems: Public address (PA) system, Home theatre sound system 5.4 Maintenance and troubleshooting of Digital TV: LCD and LED 5.5 Maintenance and Troubleshooting procedure of home appliance: Microwave Oven and Washing Machine 5.6 Maintenance and Troubleshooting procedure of office appliances: MF printer, CCTV, Projector

9. SUGGESTED SPECIFICATION TABLE FOR QUESTIONPAPER DESIGN:

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Audio Systems	9	8	4	2	14
II	Television Systems	9	6	6	2	14
III	Domestic Appliances	8	6	6	2	14
IV	Office Appliances	8	6	6	2	14
V	Maintenance and troubleshooting	8	2	6	6	14
Total		**42**	**28**	**28**	**14**	**70**

Legends: R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)

10. SUGGESTED STUDENT ACTIVITIES:

Other than the classroom and laboratory learning, following are the suggested student related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

Students should perform following activities in group and prepare reports of about 5 pages for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews.

For micro project reports should be as per suggested format, for other activities students and teachers together can decide the format of the report. Students should also collect/record physical evidences such as photographs/videos of the activities for their (student's) portfolio which will be useful for their placement interviews:

a) Troubleshoot the common consumer electronics products like digital TV, Washing machine, microwave oven, refrigerator, MF printer, Air conditioner etc.
b) Conduct market survey for latest home appliances and compare specifications of reputed brands and prepare a report.
c) Diagnose fault in the non working home appliance and rectify that.
d) Discuss case study of any fault detection and rectification problem.
e) Maintain the office/domestic electronic equipments.
f) Make visit to service centers of gadgets/equipment covered in curriculum and if possible work there for some days on voluntarily basis during holidays.
g) Search internet websites for DYS (Do Your Self) information for repair of electronic gadgets/equipment or collect manuals for repair and maintenance and try your hands to repair some gadgets/equipment based on that.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any):

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a) Arrange demonstration sessions of maintaining equipment/gadgets in labs by inviting engineers/technicians working in service centers of reputed makes as visiting lecturers for lab sessions
b) Show video/animation films to demonstrate the working principles, constructional features, testing and maintenance procedures of various home appliances.
c) Show video/animation film explaining different field applications of PLC, DCS and SCADA.
d) Prepare a chart related to PLC, DCS and SCADA Hierarchy
e) Arrange a visit to nearby manufacturer of consumer electronics products.
f) Arrange visit to repair centers of reputed makes of consumer goods suppliers.
g) Implement value addition circuits for the consumer electronic product based on Innovative ideas.
h) Arrange group discussions on the troubleshooting of electronic equipment issues.
i) Arrange seminar on safety and maintenance issues (ask students to explore the internet and visit nearby industries to collect information regarding the chosen topic/issue)

12. SUGGESTED MICRO-PROJECTS:

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. The micro-projects are group-based (group of 3 to 5 students). The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The duration

of the micro project should be about 14- 16 (fourteen to sixteen) student engagement hours during the course. The students ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

a) Build a circuit for continuity tester with buzzer and LED indicator.
b) Build a circuit of DC voltage regulator on general purpose PCB.
c) Trace the circuit of DC power supply, create faults in diodes, resistor, capacitor, voltage regulator IC etc and diagnose the faults and rectify it.
d) Prepare reports on operation and maintenance of photovoltaic and Energy Storage Systems.
e) Prepare reports on operation and maintenance of microwave oven.
f) Prepare testing charts of active components like diode, transistor, SCR, TRIAC etc.

13. SUGGESTED LEARNING RESOURCES:

Sr No.	Title of Book	Author	Publication with place, year and ISBN
1	Consumer Electronics	Bali S.P.	Pearson Education India,2010 , latest edition
2	Audio video systems: Principle practices & troubleshooting	Bali R and Bali S.P.	Khanna Book Publishing Co. (P) Ltd., 2010Delhi , India, latest edition
3	Modern Television practices	Gulati R.R.	New Age International Publication (P) Ltd. New Delhi Year 2011, latest edition
4	Mastering Digital Television	Whitaker Jerry & Benson Blair	McGraw-Hill Professional, 2010 , latest edition
5	Standard hand book of Audio engineering	Whitaker Jerry & Benson Blair	McGraw-Hill Professional, 2010 , latest edition
6	Troubleshooting and Maintenance of Electronics Equipment	Singh K. Sudeep	Katson Book ,New Delhi ,II edition , Reprint 2014
7	Troubleshooting Electronic Equipment: Includes Repair and Maintenance, Second Edition	Khandpur R. S.	Tata McGraw-Hill Education, New Delhi ,India , latest edition
8	Data Books	National semiconductor	National semiconductor

14. SOFTWARE/LEARNING WEBSITES:

a) Electronics Work bench
b) Multisim for Analog and Electronics Circuit design and simulation.
c) Electric Circuit Studio

15. PO-COMPETENCY-CO MAPPING:

Semester 1	Elements of Electrical and Electronics Engineering (Course Code: 1313202)						
	POs						
Competency & Course Outcomes	(1) Basic & Discipline specific knowledge	(2) Problem Analysis	(3) Design/ development of solutions	(4) Engineering Tools, Experimentation &Testing	(5) Engineering practices for society, sustainability & environment	(6) Project Management	(7) Lifelong learning
(1) Select relevant microphones and loudspeakers.	3	1	1	1	1	1	3
(2) Test working of various colour TV	3	3	1	3	3	1	3
(3) Describe functionality of various electronic domestic appliances	3	2	2	3	3	2	3
(4) Describe functionality of various electronic office appliances.	3	2	3	3	3	2	3
(5) Follow standard maintenance procedures to maintain various domestic and office appliances.	3	3	3	3	3	3	3
Competency: Maintain and troubleshoot various consumer electronic domestic/office appliances.							

17. COURSE CURRICULUM DEVELOPMENT COMMITTEE:

GTU Resource Persons

Sr No.	Name and Designation	Institute	Contact No.	Email
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