Program Name	: **Diploma in Electronics and Telecommunication Engineering**
Program Code	: **EJ**
Semester	: **Fourth**
Course Title	: **Maintenance of Electronics Equipment and EDA Tools Practices**
Course Code	: 22036

1. RATIONALE

Equipments with electronic circuitry are increasingly being used in all the industries and maintenance of them is the essential work for the proper functioning of the complete system. This course will enable the students to develop skills to maintain the basic electronic circuitry used in electronic equipment. This course will also enable them to fulfill the basic prerequisite for the advance maintenance issues which they will face in the industries.

2. COMPETENCY

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

- **Maintain the electronic Equipment/Appliance/Gadgets using EDA tools.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

a. Select maintenance policy for specified Equipment/Appliance/Gadgets.
b. Select troubleshooting tools for specified work.
c. Maintain the electronic home appliance/consumer electronic products.
d. Simulate electronic circuits using EDA tools.
e. Troubleshoot electronic circuit using the EDA tools.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
				Paper Hrs.	Theory						Practical					
L	T	P			ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
-	-	4	4	-	-	-	-	-	-	-	50@	20	50~	20	100	40

*(~²): For the **practical only courses**, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e 30 marks) and micro-project assessment (seen in section 12) has a weightage of 40% (i.e.20 marks). This is designed to facilitate attainment of UOs holistically, as there is no theory ESE.*

Legends: L-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit, **ESE** -End Semester Examination; **PA** - Progressive Assessment, **'#':** No Theory Examination

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the

course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.
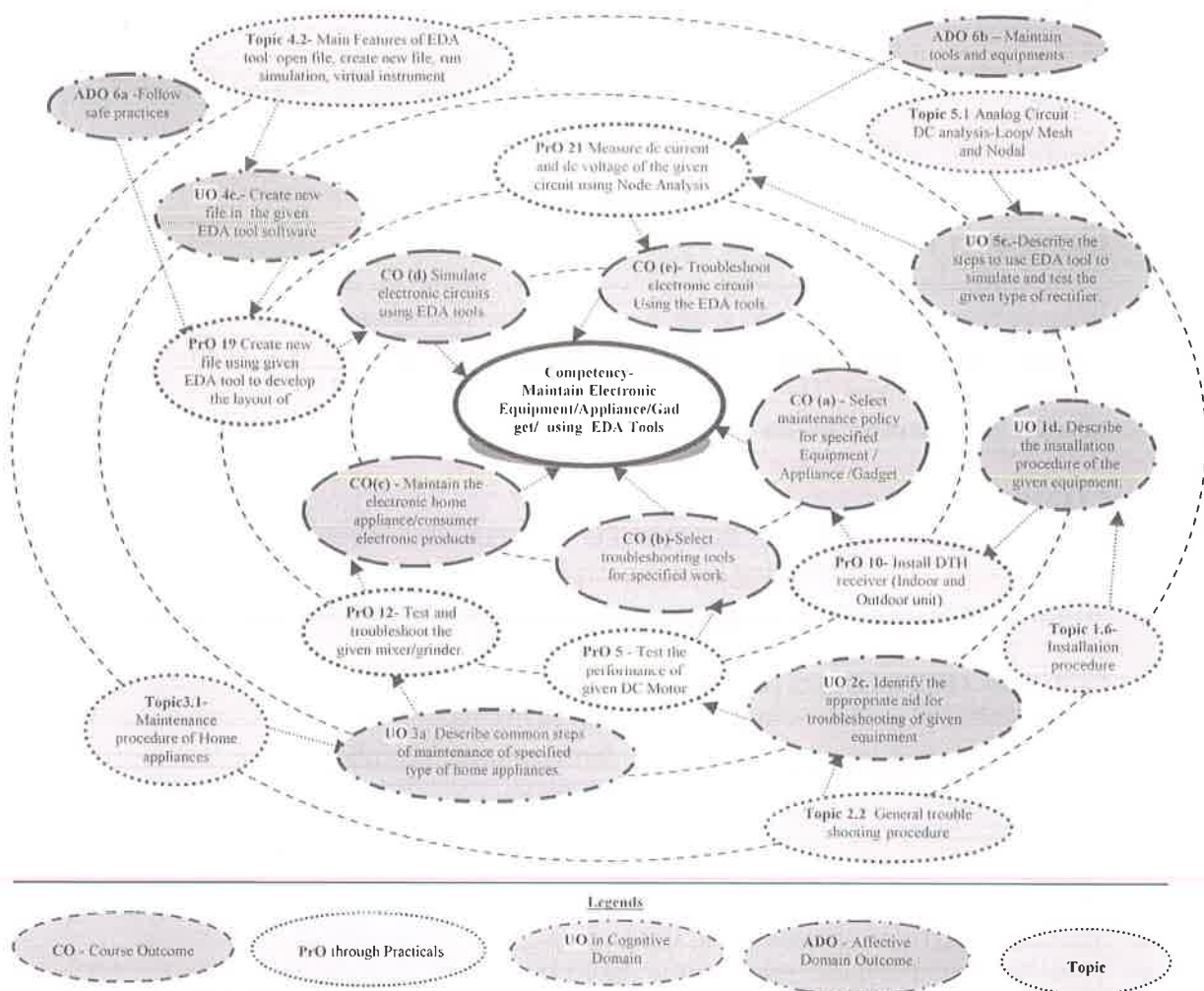

Figure 1 - Course Map

6.   SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Prepare the work order for the maintenance of the given equipment.	I	02*
2	Prepare Bin card for the maintenance of given equipment.	I	02
3	Install closed circuit television(CCTV)	I,III	02
4	Install online/ offline UPS.	I,III	02
5	Test the performance of the given (fractional horse power) DC Motors.	II	02
6	Test the performance of the given Stepper Motor.	II	02
7	Identify / Test various ICs (Analog and Digital) using IC tester (Analog and Digital).	II	02*
8	Troubleshoot the data projector.	III	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
9	Troubleshoot the circuit breaker(MCB and ELCB).	III	02
10	Install DTH receiver (Indoor and Outdoor unit).	I,III	02*
11	Troubleshoot the regulated power supply circuit of the given equipment.	III	02*
12	Troubleshoot the given mixer /grinder with fractional horse power.	III	02
13	Assemble various parts of computer system and install operating system, application software and antivirus on a computer system.	III	02
14	Troubleshoot the domestic water level controller.	III	02
15	Troubleshoot the electronic weighing machine.	III	02
16	Troubleshoot the emergency light system.	III	02
17	Troubleshoot the photo voltaic solar panel power system.	III	02
18	Create new file using given EDA tool to develop the layout of regulated power supply circuit.	IV	02
19	Measure dc current and dc voltage of the given circuit using Node Analysis through EDA simulation tool.	V	02
20	Simulate/Test half wave rectifier circuit using EDA tool.	V	02*
21	Measure ac current and voltage of RL, RC and RLC in ac circuit with EDA tool.	V	02
22	Use EDA tool to draw and simulate schematic circuit of full wave rectifiers.	V	02
23	Use EDA tool to simulate two stage RC coupled/transformer coupled/ dc coupled amplifier.	V	02
24	Use EDA tool to draw and simulate given circuit of inverting /non-inverting amplifier using IC741	V	02
25	Use EDA tool to simulate 3-bit adder to match truth table.	V	02
26	Use EDA tool to simulate 4:1 multiplexer, 1:8 demultiplexer to match truth table.	V	02
27	Use EDA tool to simulate BCD to seven segment decoder.	V	02
28	Develop the PCB of power supply circuit using (layout in Expt. 19).	V	02
	Total		**56**

Note

i. *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 24 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.*

ii. *The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
1	Identify the requirements of practical set up	15
2	Operate equipment skillfully	20
3	Record Observations	20
4	Submit report in time	30
5	Attendance and punctuality	15

	Total	100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

    a. Follow safe practices.
    b. Maintain tools and equipment
    c. Demonstrate working as a leader / a team member.
    d. Awareness of EDA Tools.
    e. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Dual Power supply 0- 30V, 2A	2-20
2	Cathode Ray Oscilloscope, Dual Trace 50MHz and above, 1MegaΩ Input Impedance	2-20
3	Function Generator 0-2 MHz with sine, square and triangular wave output with variable frequency and amplitude	3-5,11-13
4	Digital IC tester: Tests a wide range Digital IC's such as 74 Series, 40/45 Series of CMOS IC's ,Microcontroller, Memories	8
5	Analog IC tester: Test the general purpose analog ICs :Op-Amp, Voltage regulator, power amplifier, PLL,VCO	8
6	EDA tools like: eSim/ LTSPICE /TINA/OrCAD/ MultiSim/SPICE/ /Easy EDA /Circuit Logix/ MicroCap /SciLAB	21-28
7	Personal Computer, 4GB RAM. 500GB HDD , higher Processor	21-28
8	D.C. Motor, Stepper Motor	
9	Set up of DTH sample : Dish Antenna ,Universal LNBF, Low Loss RF cable (RG-6) , Satellite Receiver with Remote Controller (SATTOP Box) , Audio Video Cable	10
10	Television set 21″LCD and LED	10
11	Set up of CCTV installation sample: 4CH DVR, harddisk500Gb, IR Dome camera, video cable. power supply(12v.1Amp.)	03
12	Projector, screen	
13	MCB,ELCB	09
14	For practical related to simulation use	

S. No.	Equipment Name with Broad Specifications	PrO. No.
	scilab/octave/pspice/LTpspice/matlab/multi sim/protues or any other open source software	

8.   UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Maintenance management and troubleshooting	1a. Explain with sketch the steps of the given electronic equipment maintenance. 1b. Explain the maintenance policy for the given equipment. 1c. Choose the service option for the maintenance of the given equipment with justification 1d. Describe the software installation procedure for the given equipment. 1e. Describe the procedure to troubleshoot the specified equipment.	1.1 Objectives of maintenance management; Service and maintenance laboratory 1.2 Maintenance policy: Concept of Warranty and guarantee; Equipment service options 1.3 Interpreting the service and operation manuals 1.4 Troubleshooting process 1.5 Fault finding tools and instruments 1.6 Troubleshooting techniques and measures 1.7 Software Installation procedure and policies.
Unit– II Fundamentals of troubleshooting	2a. Describe with block diagram the wiring diagram of the given equipment. 2b. Describe the procedure to locate the fault in the given equipment. 2c. Identify the relevant tools for troubleshooting of the given equipment. 2d. Choose the relevant measure to troubleshoot the given equipment with justification.	2.1 Block, circuit, wiring/line diagram of specified equipment 2.2 General troubleshooting procedure 2.3 Fault finding tools 2.4 General troubleshooting techniques 2.5 General troubleshooting measures
Unit– III Maintenance of electronic domestic appliances	3a. Describe common steps of maintenance of the given home appliances. 3b. Describe common steps of installation of DTH. 3c. Describe common steps of installation of solar power system. 3d. Explain steps to install surveillance system. 3e. Describe the procedure to troubleshoot the specified	3.1 Maintenance of home appliances,battery charger, water level controller, emergency light system, SMPS , public address (PA)system 3.2 Demonstration of offline/online UPS and DTH 3.3 Installation of solar power system 3.4 Mobile hardware 3.5 Surveillance system- CCTV

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	electronic home appliance.	
Unit-IV EDA tool and other simulation software	4a. Write main features of the given EDA tool. 4b. Describe the procedure to use different windows to perform the given operations. 4c. Describe the procedure to Create new file in the given EDA tool software. 4d. Describe the procedure to Make changes in the given file.	4.1 Introduction to any of the EDA tools: [SCILAB, esim, spice, LabVIEW, proteus, Orcad, Multisim, TINA,MATLAB, or any other] 4.2 Main Features of EDA tool: open file, create new file, run simulation, virtual instrument 4.3 Editing windows, functions, controls 4.4 File formats, report generation in the given EDA tool
Unit –V Circuit analysis using EDA Tools	5a. Describe the procedure to Determine the current flowing through the component of the given circuit using Mesh analysis/Nodal . 5b. Calculate current through and voltage across component of the given RLC circuit to check the same with EDA tool. 5c. Describe the steps to use EDA tool to simulate the given type of rectifier. 5d. Sketch the MUX/DEMUX tree for the given number of input and output lines to simulate using EDA tool. 5e. Describe with sketches the process of making PCB for the given circuit.	5.1 Analog Circuit: DC analysis -Loop/ Mesh and Nodal; AC analysis - RL, RC and RLC circuit, peak value, RMS value and Phase value. Op-Amp based circuits: inverting / non inverting amplifiers 5.2 Digital Circuit: Boolean expressions, Logic Gates, Combinational circuit:-Adder, subtractor, multiplexer, decoder. Sequential circuit- flip-flops 5.3 PCB: layout, etching, drilling, mounting, soldering and testing)

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN
- Not applicable -

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 conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:
   a. Prepare journals based on practical performed in laboratory.
   b. Diagnose fault in the non working home appliance and rectify that.

    c. Discuss case study of any fault detection and rectification problem.
    d. Maintain the office electronic equipment.
    e. Search internet websites about manufacturer, specifications and cost of the measuring and testing equipment.
    f. Arrange visit to nearby service electronic industry and prepare the report.

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. Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
    b. *'L' in item No. 4* does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
    c. About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
    d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
    e. Guide student(s) in undertaking micro-projects.
    f. Demonstrate students thoroughly before they start doing the practice.
    g. Encourage students to refer different websites to have deeper understanding of the subject.
    h. Observe continuously and monitor the performance of students in Lab.

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. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be *individually* undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should *not exceed three.*

    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 total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

    A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

    a. Proforma for Logbook - Each group will prepare proforma of logbook, preventive and corrective maintenance (for Any one equipment in laboratory)
    b. Prepare a flow chart for fault diagnosis of equipment/gadget available in the laboratory(CRO, Function generator, power supply etc.)
    c. Simulate and build circuit on general purpose PCB of Half adder
    d. Prepare annual maintenance record of UPS available in college/housing society
    e. Prepare proposal for installation and maintenance of EPABX system
    f. Prepare proposal for installation and maintenance solar photovoltaic module
    g. Design and simulate simple emergency light system using any EDA tool.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Trouble Shooting Electronic Equipment: Includes Repair and Maintenance	Khandpure, R.S.	Mcgraw-Hill Publishing, New Delhi, 2014, ISBN-9780070483576
2	Troubleshooting and Maintenance of Electronics Equipment	Singh, K. Sudeep	Katson Book ,New Delhi, Reprint 2013, ISBN: 978-8188458639
3	Handbook of Repair and Maintenance Of Domestic Electronics Appliances	Sinha, Sakshi Bhushan	BPB Publications, New Delhi, 2016, ISBN:9788183335027
4	Electronic Instruments and System	Gupta, R.G.	Mcgraw-Hill Publishing New Delhi, 2014,ISBN:9780074636299
5	Network Analysis and Synthesis	Ghosh, S.P.; Chakrabarti, A.K.	McGraw Hill Education, New Delhi, 2010, ISBN: 9780070144781
6	Electronics Devices and Circuit Theory	Boylestad, Robert L.	Pearson Publication, New Delhi, 2015, ISBN: 9788131727003
7	The Complete PC Upgrade & Maintenance Guide	Mark, Minasi	Willey Publication, New Delhi, 2010, ISBN: 9788126506279

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

a. Open source EDA tool for circuit simulation:- www.esim.fossee.in
b. Tutorial for e-sim software :- esim.wikia.com/wiki/Tutorial_the_basics_of_e-sim
c. Scilab software:- www.scilab.org/download/latest
d. Scilab tutorial:-www.scilab.org/resources/documentation/tutorial
e. Tina software official website:- https://www.tina.com
f. Tina software tutorial:-https://www.tina.com/tutorials
g. LT spice software:-http://www.linear.com/designtools/software/#LTspice
h. Open source hard ware project:- http://www.electronics-lab.com/downloads/circutedesignsimulation/?page=5 /
i. Circuitlogix software :-https://www.circuitlogix.com/student_version.ph
j. Spectrum soft ware:- www.spectrum-soft.com/
k. Free e-book:-www.talkingelectronics.com/projects/...1A/BasicElectronics-1A_Page1.html
l. Troubleshooting support:- www.fixya.com
m. Tutorial Combinational logic:- www.electronics-tutorials.ws › Combinational Logic
n. Security camera:-http://www.wikihow.com/Install-a-Security-Camera-System-for-a-House
o. Home theater:-http://www.audioholics.com/projector-screen-reviews/how-to-mount-projector-and-screen-in-home-theater