Course Name : **All Branches of Diploma in Engineering and Technology**
Course Code : **DE/EJ/EN/EQ/ET/EX/IE/MU/ IS/IC**
Semester : **First**
Subject Title : **Workshop Practice**
Subject Code : **22006**

1. RATIONALE

Electronic engineering diploma holders are expected to handle various mechanical, electrical and electronics tools in the workshop. The diploma engineer has to supervise soldering, sheet metal work, fitting of electronic components and circuits in the workshop. This course will develop skills in handling tools, equipments used in the electronics workshop and perform soldering of components primarily.

2. COMPETENCY

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

- **Build /test simple electronic circuit on breadboards and PCBs.**

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. Use firefighting equipment and other safety related accessories.
b. Use fitting and sheet metal tools in the electronics workshop.
c. Identify active and passive electronics components.
d. Perform soldering and de-soldering using soldering tools.
e. Build simple jobs in the electronics workshop.

4. TEACHING AND EXAMINATION SCHEME

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

*(~[2]): For the courses having **ONLY practical** examination, 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 COs 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.*

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.

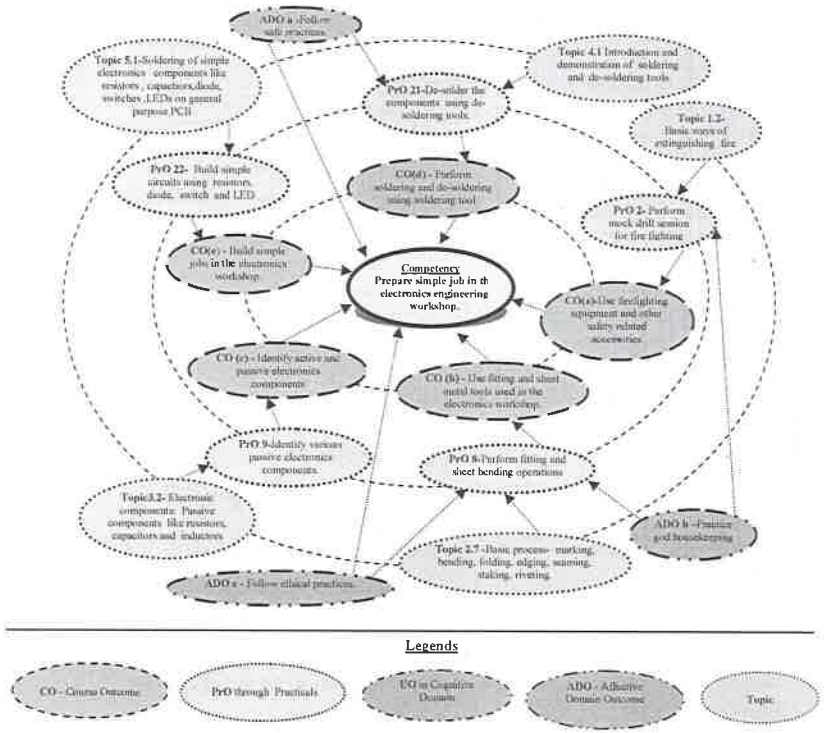

Figure 1 - Course Map

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	Use relevant safety symbol from standard safety chart for a given situation.	I*	2
2	Perform mock drill session for firefighting using various classes of fire extinguishers and related accessories.	I	2
3	Select hand tools and equipment used in fitting Shop.	II*	2
4	Select machine tools and equipment used in fitting Shop.	II	2
5	Identify various fitting tools based on given specifications.	II	2
6	Identify various sheet metal tools based on given specifications.	II	2
7	Prepare the given fitting job as per given drawings Part-I	II*	2
8	Prepare the given fitting job as per given drawings Part-II	II	2

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
9	Prepare the given fitting job as per given drawings Part-III	II	2
10	Prepare the given fitting job as per given drawings Part-IV	II	2
11	Prepare the given fitting job as per given drawings Part-V	II	2
12	Identify the given hand tools, machine tools and equipment used in sheet metal shop to sketch and write the applications and specifications of each – Part I.	II*	2
13	Identify the given hand tools, machine tools and equipment used in sheet metal shop to sketch and write the applications and specifications of each – Part II.	II*	2
14	Prepare two simple sheet metal jobs as per given drawings Part-I	II*	2
15	Prepare two simple sheet metal jobs as per given drawings Part-II	II	2
16	Prepare two simple sheet metal jobs as per given drawings Part-III	II	2
17	Prepare two simple sheet metal jobs as per given drawings Part-IV	II	2
18	Perform sheet metal and fitting operation for the given utility job. Part-I	II	2
19	Perform sheet metal and fitting operation for the given utility job. Part-II	II	2
20	Perform sheet metal and fitting operation for the given utility job. Part-III	II	2
21	Perform sheet metal and fitting operation for the given utility job. Part-IV	II	2
22	Identify various: (a) Passive electronic components in the given circuit. (b) Active electronics components in the given circuit.	III*	2
23	Identify various controls available on the front panel of analog and digital multimeter.	III	2
24	Determine the value of given resistor using digital multimeter to confirm with colour code.	III*	2
25	Test the semiconductor diodes using digital multimeter.	III*	2
26	Test the LEDs display using multimeter.	III	2
27	Test 7-segment display using multimeter.	III	2
28	Identify three terminals of a transistor using digital multimeter.	III*	2
29	Connect resistors in series and parallel combination on bread board and measure its value using digital multimeter.	III	2
30	Connect capacitors in series and parallel combination on bread board and measure its value using multimeter.	III	2
31	Indentify primary and secondary winding of step down transformer using multimeter.	III	2
32	Identify relay terminals (coil, common, normally open and close)	III	2
33	De-solder the components using de-soldering tools.	IV*	2
34	Build simple circuits using resistors, diode, switch and LED.	III,V	2
35	Build simple circuits using relay and other electronics components.	III, V*	2
36	Test the circuit developed in the experiment No.35 using various testing equipment.	III, V*	2
37	Solder more than two components on PCB for continuity.	V*	2

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	Total		**74**

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	Setting of experimental set up	20
2	Operate equipment skillfully	30
3	Follow Safety measures	10
4	Work in team	10
5	Record Observations	10
6	Interpret Results to conclude	10
7	Answer to sample questions	5
8	Submit report in time	5
	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 safety practices.
b. Practice good housekeeping.
c. Demonstrate working as a leader/a team member.
d. Maintain tools and equipment.
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
- '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 PrOs, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. No.
1	Mechanical foam type fire extinguisher with ISI mark (9 litter, B and C type	1

S. No.	Equipment Name with Broad Specifications	Exp. No.
	fire)	
2	A, B,C portable type fire extinguisher with ISI mark.	I
3	Bench Drilling machine (up to 13 mm drill cap.) with ½ H.P. Motor 1000 mm. height	II
4	Work Benches: 1800mm*1900mm*750mm	II
5	Power Saw machine 350 mm mechanical with 1 HP Motor & all Accessories.	II
6	Bench Grinder 200 mm Grinding Disc diameter 200 mm. with 25 mm. bore 32 mm. with ½ HP/1HP Motor.	II
7	Vernier height Gauge 450 mm	II
8	Surface Plate 600 x 900 mm Grade I	II
9	Angle Plate 450 x 450 mm	II
10	Bench Vice 100 mm	II
11	Power Saw machine 350 mm mechanical with 1 HP Motor and all Accessories.	II
12	Circular Saw Machine, Diameter of saw blade 200 mm, Maximum Depth of Cut 50 mm, Table Size -350 x 450 mm, Table Tilting - 450	II
13	CRO: 50MHz, Dual trace, Dual beam, Inbuilt +-5 V supply, Component tester, Function Generator	III
14	Soldering Gun: 40Watts, Holding stand, Temperature Control, Power cord	III,I,V
15	De-soldering Gun: 80 Watts, output voltage 24 V	III,IV,V
16	Multimeter 3 and ½ digit with component tester	III,IV,V
17	Wire Cutter	III,IV,V
18	Wire Stripper	III,IV,V
19	Consumable components: Resisters, capacitors, Diodes, Transistors, ICs, IC Sockets, General Purpose PCBs, LEDs, Relays, Switches, Connectors, Connecting Wires, Soldering metal, Soldering Flux, De-soldering mesh.	III,IV,V

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics are to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I General Workshop Practice and Fire Fighting	1a. Describe the procedure for extinguishing the given type of fire 1b. Describe the procedure to use the given fire fighting equipment 1c. Locate the specified equipment in workshop 1d. Describe the ways to maintain good housekeeping in the given situation.	1.1 Safety Practices, Causes of accidents, General safety rules, Safety signs and symbols. 1.2 First Aid 1.3 Fire, Causes of Fire, Basic ways of extinguishing the fire Classification of fire, Class A, B,C, D. Firefighting equipment, fire extinguishers, and their types . 1.4 Workshop Layout 1.5 Issue and return system of tools, equipment and consumables

Unit– II Fitting and Sheet Metal Shop	2a. Explain operation of the given fitting shop machines 2b. Describe the procedure to use the given fitting tools 2c. Describe the operation the given machinery. 2d. Describe the procedure to perform the given fitting operations 2e. Describe the procedure to maintain the given tools, equipment and machinery. 2f. Explain the given type of welding procedure. 2g. Describe the procedure to use the given metal joining tools.	2.1 Fitting hand tools and their specifications: bench vice, hammers, chisels, files, hacksaw, surface plate, punch, V block, angle plate, try square, marking block , steel rule, twist drills, reamers, tap set, die set Machineries and their Specifications in fitting shops- Drilling machine, Power saw, grinder 2.2 Basic process chipping, filling, scraping, grinding, marking, sawing, drilling, tapping, dyeing, reaming etc. 2.3 Sheet metal hand tools and their Specifications: snip, shears sheet gauge, straight edge, L square, scriber, divider, trammel, punches, pliers, stakes, groovers, limit set 2.4 Machinery and their Specifications in sheet metal shops- sheet cutting and bending machine 2.5 Basic process- marking, bending, folding, edging, seaming, staking, riveting.
Unit– III Identification of Electronic Components	3a. Explain working of given type of electronics circuits . 3b. Identify given type of active and passive electronics components. 3c. Describe steps to use the given type of multimeter. 3d. Describe the steps to test the given electronics components using the multimeter.	3.1 Sources: AC and DC, Batteries. 3.2 Electronic components: Passive components like resistor, capacitor and inductor, Active components like diode, transistor, IC. 3.3 Switches, relays, LEDs, 7-segment display, step-down transformer, connectors and cables used in electronics circuits. 3.4 Data sheet and the catalog of electronics components, multimeter. 3.5 Tools required for electronic workshop :specifications, cost and other improtent characteristics (Catalogs of multimeter, power supply, and soldering machine to collect the latest information of tools).
Unit– IV Electronic Soldering Shop	4a. Select the soldering and de-soldering tools for the given job. 4b. Describe procedure for using the given soldering related component. 4c. Explain function of the given type of desoldering device. 4d. Describe problems of given	4.1 Soldering and de-soldering tools like normal soldering gun, temperature controlled soldering gun, soldering metals, soldering flux, soldering pot, De-soldering gun, De-soldering pump, De-soldering mesh. 4.2 Soldering techniques like hand soldering, wave soldering and dip soldering.

	type of soldering.	4.3 Dry soldering, problems of dry and loose soldering.
Unit– V Hands On Skills	5a. Describe the procedure to build given type simple electronic circuit on bread board. 5b. Explain the procedure of assembling given simple electronic circuit on general purpose PCB . 5c. Explain the procedure to use the given type of meter for continuity testing. 5d. Explain the procedure to test the continuity of the given circuit using the given type of digital multimeter.	5.1 Soldering of simple electronics components like resistors, capacitors, diode, switches, LEDs on general purpose PCB. 5.2 De-soldering of the components from the PCB. 5.3 Continuity testing using multimeter. 5.4 Measurement of Series and parallel combination of resistors and capacitors.

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.

a. Prepare chart displaying various electronics components and Instrument.
b. Prepare broad specifications of tools and equipment used in the electronics workshop with the help of handbooks and product catalogues available on internet.
c. List specifications of various electronics components.
d. Download the catalogue of multimeter, CRO, soldering gun, relays and connectors of various reputed manufacturers from websites to update the latest developments.
e. Undertake a market survey of local dealers for procurement of workshop tools, equipment machineries and raw material.

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. Show video/animation films to explain functions of fire extinguisher and fire fighting procedure.
g. Arrange visit to nearby electronics manufacturer/testing Industry.
h. Show video/animation films to explain functioning of electronics components and their application.
i. Assign micro projects to students on simple electronics circuits.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. 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.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare chart showing comparison of various types of resistors used in the electronics Industry.
b. Build heat sink for the given specification.
c. Build a cabinet for the given circuit/ equipment/ instrument.
d. Solder components on PCB and check the continuity.
e. Test the active and passive components connected in the given electronic equipment.
f. Prepare small report on market survey on diodes used in the small electronics industry.
g. Prepare the specifications of active and passive components and their manufacturers and their addresses.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	A Course in Workshop Technology	Raghuwanshi, B.S.	Dhanpat Rai sons, New Delhi ; 2011, or latest edition, ISBN:0000017108
2	A Textbook of Manufacturing Process (Workshop Technology)	Gupta, J.K.; Khurmi, R.S.	S.Chand and Co. New Delhi, or latest edition, ISBN:81-219-3092-8
3	Electronic Components Handbook	Jones, Thomas H.	Reston Publishing, Reston, Virginia, United states latest edition, ISBN: 9780879092221
4	Principles of Electronics	Mehta ,V.K.; Mehta, Rohit	S. Chand and Co. Ram Nagar, New Delhi-110 055, 2014, ISBN: 9788121924504

14. SOFTWARE/LEARNING WEBSITES

a. www.nptel.iitm.ac.in

b. http://www.eleccircuit.com
c. http://www.electroschematics.com
d. http://www.asnu.com.au
e. http://fireextinguishertraining.com/
f. www.youtube.com/watch?v=WE-SislzSMY
g. www.youtube.com/watch?v=lUojO1HvC8c
h. https://mightyohm.com/files/soldercomic/FullSolderComic_EN.pdf
i. http://www.aura-o.aura-astronomy.org/aura/sites/default/files/files/Referencia_Bibliografica