Maharashtra State Board of Technical Education (MSBTE)

I – Scheme
II – Semester Course Curriculum

Course Title**: Basic Electronics** (DE, EJ, IE, IS)
(Course Code: .....)

Diploma Programme in which this course is offered	Semester in which offered
Digital Electronics, Electronics and Telecommunication Engineering, Industrial Electronics, Instrumentation Engineering	Second

1. RATIONALE

Diploma engineers have to deal with the various electronic components while maintaining various electronics equipment. The study of basic operating principles and handling of various electronics devices will help them to troubleshoot electronics equipment. This course is developed in such a way that, students will be able to apply the knowledge to solve broad electronic engineering application problems.

2. COMPETENCY

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

- **Maintain electronic circuits comprising of discrete electronic components.**

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 relevant diode in different electronics circuits.
b. Maintain rectifiers comprising of diodes.
c. Use BJT in electronics circuits.
d. Use FET in electronics circuits.
e. Maintain DC regulated power supply.

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	-	4	8	70	30*	50	50	200

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

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, Learning Outcomes i.e.LOs 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.

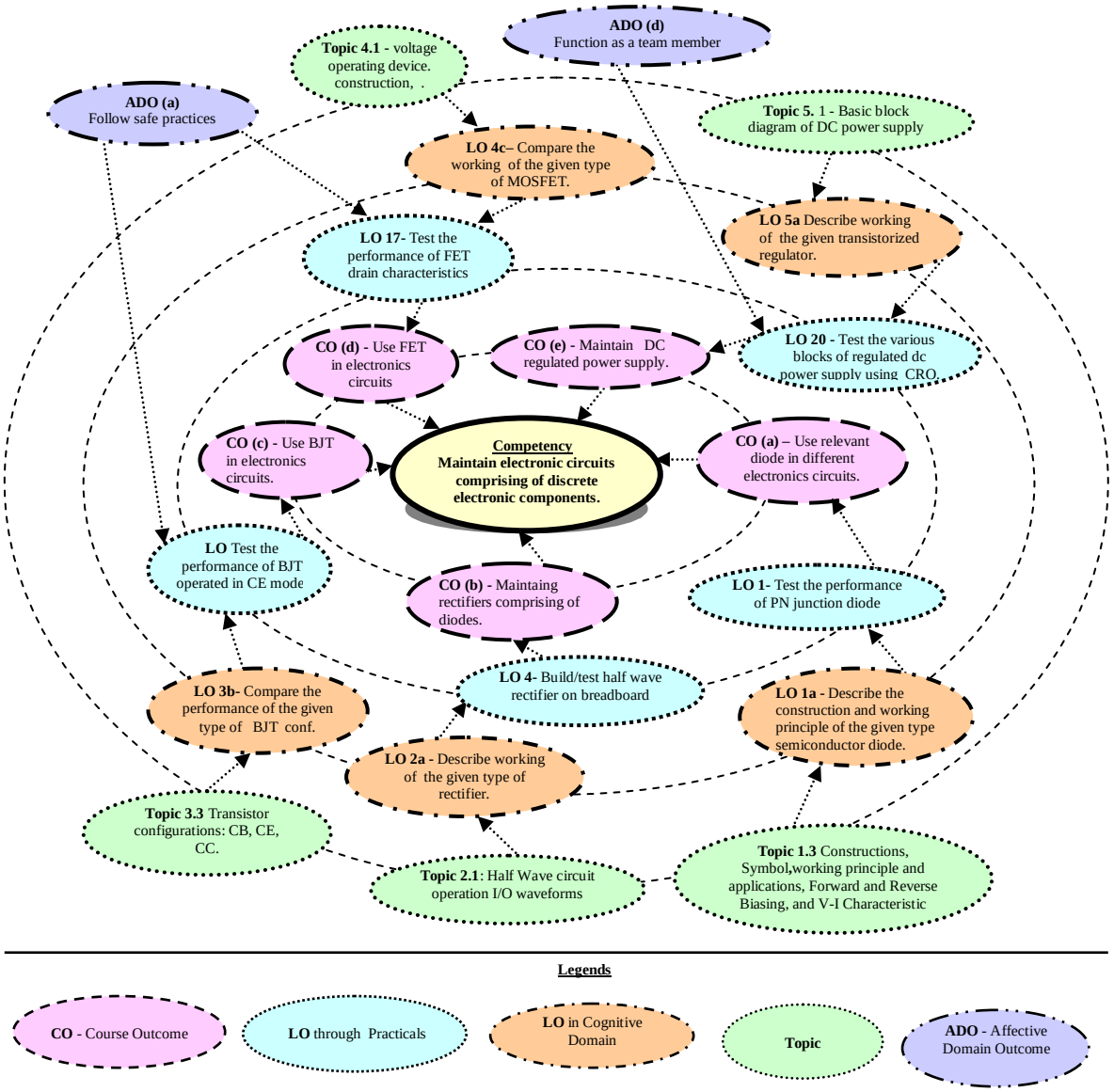

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals/exercises/tutorials in this section are psychomotor domain LOs (i.e.sub-components of the COs), to be developed and assessed in the student to lead to the attainment of the competency.

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
1	Test the performance of PN junction diode .	I	2*
2	Test the performance of zener diode.	I	2
3	Test the performance of photo diode by varying the light intensity	I	2

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
	as well as distance of the light source.		
4	Build/test half wave rectifier on breadboard	II	2
5	Build/test half wave rectifier on breadboard with filter- Part I	II	2*
6	Build/test half wave rectifier on breadboard with filter- Part II	II	2
7	Build/ test full wave rectifier on breadboard using two diodes.	II	2*
8	Build/ test full wave rectifier on breadboard using two diodes.	II	2
9	Build/ test full wave bridge rectifier on breadboard .	II	2
10	Use LC filter with fullwave rectifier to measure ripple factor.	II	2
11	Use π filter with bridge rectifier to measure ripple factor.	II	2
12	Assemble positive clipper circuit on breadboard and test the performancs.	II	2
13	Assemble Negative clipper circuit on breadboard and and test the performancs.	II	2
14	Build the combinational Clipper on breadboard and test the performance. - Part I	II	2*
15	Build the combinational Clipper on breadboard and test the performance. - Part II	II	2
16	Build positive clamper on breadboard and test the performance. - Part I	II	2
17	Build positive clamper on breadboard and test the performance. - Part II	II	2
18	Build Negative clamper on breadboard test the performance.	II	2
19	Identify the terminals of the PNP and NPN transistor using different methods . - Part I	III	2*
20	Identify the terminals of the PNP and NPN transistor using different methods . - Part II	III	2
21	Find specifications of a given transistor using data sheets.	III	2
22	Test the performance of BJT working in CE mode .	III	2
23	Test the performance of BJT working in CB mode .	III	2
24	Test the assembled BJT voltage divider bias circuit for given input. - Part I	III	2
25	Test the assembled BJT voltage divider bias circuit for given input. - Part II	III	2
26	Test the performance of FET drain characteristics , transfer characteristics and calculate trans-conductance. - Part I	IV	2*
27	Test the performance of FET drain characteristics , transfer characteristics and calculate trans-conductance. - Part II	IV	2
28	Build / test zener voltage regulator for the given voltage.	V	2
29	Test the performance of transistorized series voltage regulator for the given load regulation.	V	2
30	Test the performance of transistorized shunt voltage regulator for the given load regulation	V	2
31	Test the various blocks of regulated dc power supply .	V	2
32	Find out faults at different stages of regulated dc power supply.	V	2
33	Trouble shoot given DC regulated power supply. - Part I	V	2*
34	Trouble shoot given DC regulated power supply. - Part II	V	2

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
	Total		**68**

Note

i. *A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicial mix of minimum 24 or more practical LOs/tutorials 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. *Hence, the 'Process' and 'Product' related skills associated with each LO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		**100**

Additionally, the following affective domain LOs (social skills/attitudes), are also important constituents of the competency which can be best developed through the above mentioned 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 development of the attitude related LOs of Krathwohl's 'Affective Domain Taxonomy', the achievement level may reach:

- '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 experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S. No.
1	Variable DC power supply 0- 30V, 2A, SC protection, display for voltage and current.	1,2,3,9,10, 12,13,15, 16,17,18, 19,20 21

S. No.	Equipment Name with Broad Specifications	Exp. S. No.
2	Cathode Ray Oscilloscope Duel Trace 20Mhz, 1MegaΩ Input Impedance	4,5,6,7,8,9,10,11,12, 13,14, 22
3	Function Generator 0-2 MHz with Sine , square and triangular output with variable frequency and amplitude.	4,5,6,7,8,9,10,11,12,13
4	Digital Multimeter : 3 1/2 digit display, 9999 counts digital multimeter measures: V_{ac}, V_{dc} (1000V max) , A_{dc}, A_{ac} (10 amp max), Resistance (0 - 100 MΩ) , Capacitance and Temperature measurement	All
5	Lux meter 3000 Lumen, Battery operated hand held type	3
6	Electronic Work Bench : Bread Board 840 -1000 contact points: Positive and Negative power rails on opposite side of the board , 0-30 V, 2 Amp Variable DC power supply, Function Generator 0-2MHz, CRO: 0-30 MHz, Digital Multimeter	All

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Semiconductor Diode	1a. Describe the construction and working principle of the given type semiconductor diode. 1b. Differentiate between the given type of insulator, conductor and semiconductor based on energy band theory. 1c. Describe working principle, characteristics, and application of the given type of diode. 1d. Describe effect of temperature on the given type of diode.	1.1 Different types of Semiconductor Diodes and their materials 1.2 Energy band theory and effect of temperature 1.3 Construction, Symbol , working principle , applications, Forward and Reverse Biasing and V-I Characteristic of following diodes: PN junction, Zener, LED, Photo diode
Unit– II Applications of diodes	2a. Describe working of the given type of rectifier. 2b. Describe the need and working of the given type of rectifier filter circuit. 2c. Select clipper or clamper for obtaining the given waveform. 2d. Calculate ripple factor, PIV and efficiency of the given type of rectifier.	2.1 Types of Rectifiers: Half Wave, Full Wave Rectifier (bridge and center tapped): circuit operation I/O waveforms for voltage and current 2.2 Parameters of rectifier: Average DC value of current and voltage ripple factor ripple frequency PIV of diode, TUF, efficiency of rectifier 2.3 Types of Filters: Shunt capacitor, Series inductor, LC and π filter, bledder resistor 2.4 Clipper and Clamper circuits
Unit– III Bipolar	3a. Describe the working principle of the given type of transistor.	3.1 Current operating device 3.2 Different types of transistors: PNP,

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Junction Transistor	3b. Compare the performance of the given type of transistor configurations. 3c. Justify the biasing method for the given circuit. 3d. Describe the procedure to minimize the thermal runaway effect for the given type of transistor baising circuit.	NPN 3.3 Transistor configurations: CB, CE, CC. Transistor characteristics (input, output,) in different transistor configurations 3.4 BJT biasing: DC load line, operating point, stabilization, thermal runaway, types of biasing, fixed biasing, base bias with emitter feedback, voltage divider
Unit– IV Field Effect Transistor	4a. Explain the working of FET for the given application. 4b. Explain the given type of FET biasing method. 4c. Compare the working of the given type of MOSFET. 4d. Differentiate the working principle of FET and MOSFET on the basis of the given transfer characteristic curve.	4.1 Voltage operating device Construction of JFET (N-channel and P- channel), symbol, working principle and characteristics (Drain and Transfer characteristics) 4.2 FET Biasing: Source self bias, drain to source bias 4.3 Applications of FET 4.4 MOSFET: Construction, working principle and characteristics of Enhancement and depletion MOSFET, MOSFET handling
Unit– V Regulators and power supply	5a. Describe working of the given transistorized regulator. 5b. Describe the working of the given block of the DC regulated power supply in the block diagram. 5c. Calculate output voltage of the given zener voltage regulator circuit. 5d. Calculate load and line regulation of the given transistorized regulator.	5.1 Basic block diagram of DC regulated power supply 5.2 Load and Line regulation 5.3 Zener diode voltage regulator 5.4 Transistorized series and shunt regulator - circuit diagram and working

***Note**: To attain the COs and competency, above listed Learning Outcomes (LOs) need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.*

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Semiconductor Diode	12	3	4	7	14
II	Applications of diodes	14	3	6	7	16
III	Bipolar Junction Transistor	16	3	7	8	18

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
IV	Field Effect Transistor	12	3	4	5	12
V	Regulators and power supply	10	2	3	5	10
Total		**64**	**14**	**24**	**32**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note*: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

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 journals based on practical performed in laboratory.
b. Test different diodes using CRO.
c. Give seminar on any relevant topic.
d. Library survey regarding different data books and manuals.
e. Prepare power point presentation for wave shaping circuits.
f. Undertake a market survey of different semiconductor components.

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 LOs/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. Use PPTs to explain the construction and working of rectifier.
g. Use PPTs to explain the construction and working of wave shaping circuits.
h. Guide students for using data manuals.

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 practicals, cognitive domain and affective domain LOs. 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. **Diode**: Build a circuit on general purpose PCB to clip a positive half cycle at 1.5 v of a waveform with input signal 5Vpp., and prepare the report.
b. **Diode:** Build a circuit on general purpose PCB to clamp a waveform at 3.0V using diode and passive components.
c. **FET**: Prepare chart on comparison of specifications of FETs using data sheets of at least three FET.
d. **FET**: Prepare a chart on FETs contains its symbol, advantages and applications. .
e. **Rectifier**: Build a half wave rectifier for 6V, 500mA output current on general purpose PCB.
f. **Rectifier**: Build a full wave bridge rectifier with capacitor filter for 6V, 500mA output current on general purpose PCB.
g. **BJT:** Build a circuit to switch on and off the LED by using BJT as switching component.
h. **Photodiode:** Build a circuit on breadboard to turn the relay on and off by using photo diode and prepare a report.
i. **Voltage Regulator:** Build a circuit of DC regulated power supply on general purpose PCB for 9V and 500mA output.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Electronic Devices and Circuit: An Introduction	Mottershead, Allen	PHI Learning, New Delhi, ISBN : 9788120301245
2	Electronic Devices and Circuit Theory	Boylestead Robert, Louis Neshelsky	Pearson Education,10th edition, New Delhi,2009, ISBN: 978-8131727003
3	The Art of Electronics	Paul Horowitz Winfield Hill	Cambridge University Press, New Delhi 2015 ISBN: 9780521689175
4	Electronics Principles	Malvino, Albert Paul, David	McGraw Hill Eduction, New Delhi, ISBN: 978-0070634244
5	Principles of Electronics	Mehta, V.K. Mehta, Rohit	S. Chand and Company, Ram Nagar, New Delhi-110 055, 2014, ISBN: 9788121924504
6	Basic Electronic Engineering	Baru V., Kaduskar R.,Gaikwad S.T.	Dreamtech Press, New Delhi, 2015 ISBN: 9789350040126
7	Fundamentals of Electronic Devices and Circuits	Bell, David	Oxford University Press, International edition, USA, 2015, ISBN : 9780195425239
8	A text book of Applied Electronics	Sedha, R.S.	S.Chand ,New Delhi, 2008, ISBN**:** 978-8121927833

14. SOFTWARE/LEARNING WEBSITES

a. www.nptel.iitm.ac.in

b. www.datasheetcafe.com
c. www.williamson-labs.com
d. www.futurlec.com
e. www.bis.org.in
f. www.learnerstv.com
g. www.cadsoft.io
h. www.khanacademy.com

15. COURSE CURRICULUM DEVELOPMENT COMMITTEE

MSBTE Resource Persons

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3	Mrs. Sushama Kolhe, HOD	Guru Gobind Singh Polytechnic, Nashik		
4	Mr. R. A .Pranjale , LE, Elx	G. P. Amravati		

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