Program Name : **Diploma in Computer Hardware & Maintenance, Diploma in Artificial Intelligence and Machine Learning, Diploma in Cloud Computing and Big Data**

Program Code : **CO/CM/IF/CW/HA/AN/BD**

Semester : **Second**

Course Title : **Basic Electronics**

Course Code : **22225**

1. RATIONALE

In today's world most of the consumer appliances are based on electronic circuits and devices. The foundation for working of computer or any of its peripherals are based on electronics. This course has been designed to develop skills to understand and test simple electronic components and circuits.After studying this course students will develop an insight to identify, build and troubleshoot simple electronic circuits.

2. COMPETENCY

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

- **Use simple electronic circuits of computer system.**

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. Identify electronic components in electronic circuits.
b. Use diodes in different applications.
c. Interpret the working of junction transistor in the electronic circuits.
d. Interpret the working of unipolar devices in the electronic circuits.
e. Use sensors and transducers.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory							Practical				
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
L	T	P			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): 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 UOs 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, 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.

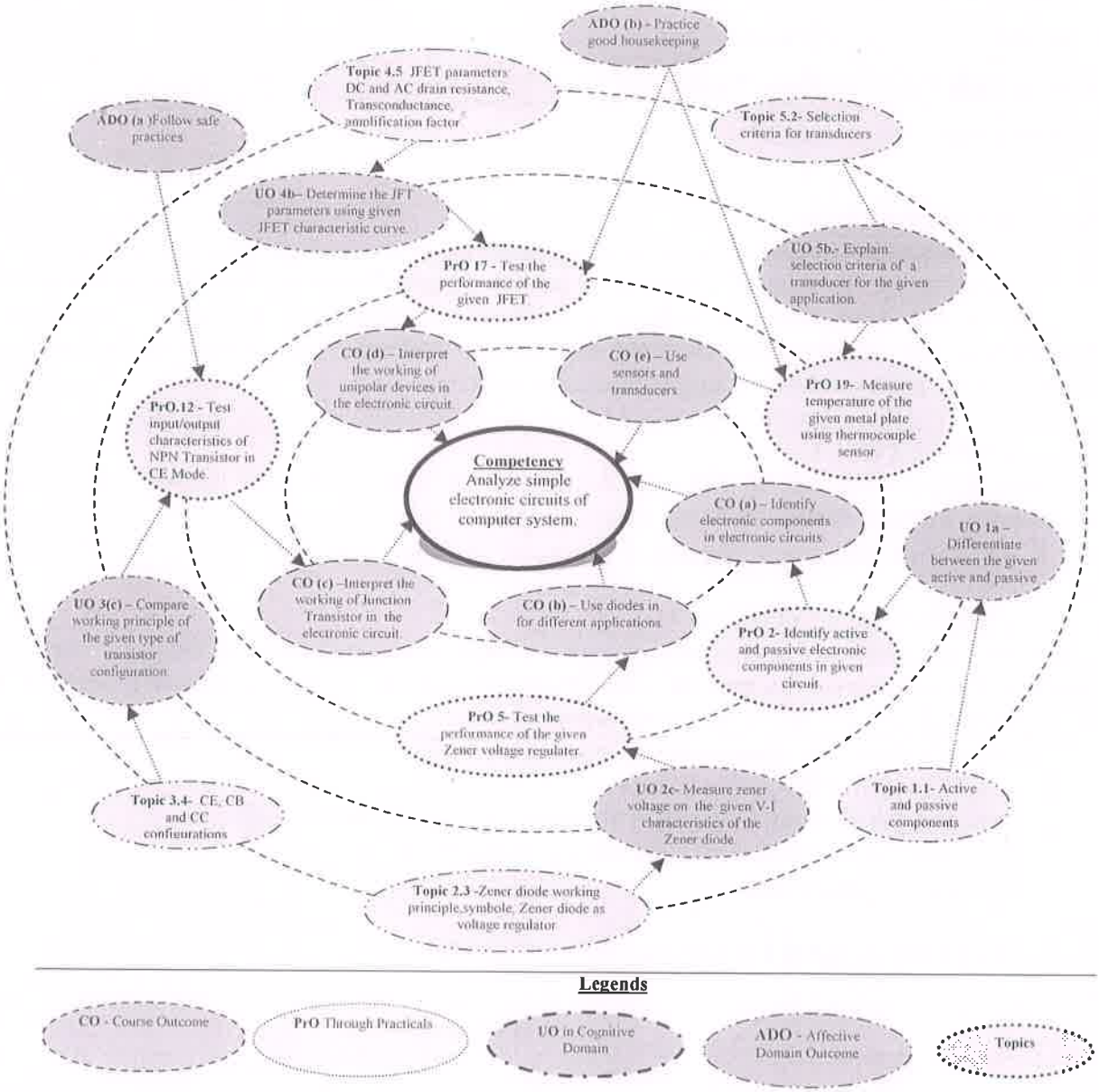

Figure 1 - Course Map

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	Measure amplitude, time period and frequency of sine wave and square wave using CRO .	I	02
2	Identify active and passive electronic components in the given	I	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	circuit.		
3	Test the performance of the given PN junction diode.	II	02*
4	Test the performance of the given Zener diode.	II	02
5	Test the performance of the given Zener voltage regulater.	II	02
6	Convert AC signal into DC signal using Half wave rectifier.	II	02
7	Convert AC signal into DC signal using full wave rectifier	II	02
8	Use filters to get regulated DC.	II	02
9	Convert AC signal into DC signal through Bridge rectifier.	II	02
10	Test the performance of the given Bridge rectifier using filter.	II	02
11	Test input/output characteristics of NPN Transistor in CE Mode.	II	02
12	Test input/output characteristics of NPN Transistor in CB Mode.	III	02*
13	Test input/output characteristics of NPN Transistor in CC Mode.	III	02
14	Determine gain and bandwidth of Single stage RC coupled amplifier.	III	02
15	Determine gain and bandwidth of 2 stage RC coupled amplifier.	III	02
16	Test the performance of the given JFET & Determine the characteristics parameter of the given JFET.	III & IV	02*
17	Measure temperature of the given metal plate using thermocouple sensor.	IV	02
18	Test the performance of the given circuit consist of photoelectric sensor.	V	02*
	Total		**36**

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 12 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	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

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

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	Single/Dual regulated Power supply(0 to 15Volts).	3-18
2	Digital multimeter ,3and ½ digit, seprate range for resistancs and capacitance,component tester, AC and DC measurement.	3 – 20
3	Dual trace CRO/DSO, 50MHz., with function generator and component tester.	1,4-18
4	Function generator, 20MHz.	1,4-18
5	Trainer kits / breadboard for Rectifiers, regulator, Transistors, JFET and RC coupled single / two stage amplifiers.	4-18
6	Heater, Thermocouple and photoelectric sensor	19,20

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics is 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 Electronic Components and Signals	1a. Differentiate between the given active and passive electronic components. 1b. Calculate value of the given resistor and capacitor using colour code. 1c. Compare the characteristics of the given voltage and current source. 1d. Interpret with sketches the given signal.	1.1 Active and passive components 1.2 Resistor,capacitor,inductor symbols,working principles, applications,colour codes, specifications. 1.3 Voltage and Current Source 1.4 Signal waveform, Time and frequency domain representation, Amplitude, Frequency, Phase, Wavelength 1.5 Types of Signals: sinusoidal, triangular and square 1.6 Integrated Circuits – analog and digital.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– II Diodes and Their Applications	2a. Explain with sketches working of the given diode using V-I characteristics. 2b. Measure zener voltage on the given V-I characteristics of the zener diode. 2c. Describe with sketches the working principle of given type of filter. 2d. Compare the salient features of the given type of rectifiers.	2.1 Symbol, construction and working principle of P-N junction diode 2.2 Rectifiers:Half wave, Full wave and Bridge Rectifier,working principle , circuit diagram, performance parameters PIV, ripple factor,efficiency, Need for filters: circuit diagram and working of 'L', 'C' and 'π'' filter. 2.3 Zener diode working principle, symbole, as voltage regulator 2.4 Symbol, construction and working principle of light emitting diode(LED) 2.5 Working principle and block diagram of regulated power supply.
Unit– III Bipolar Junction Transistor	3a. Describe with sketches the construction and working of the given type of device. 3b. Explain with sketches the working principle of the given transistor configuration 3c. Determine the current gain of the given transistor configuration. 3d. Explain with sketches the specified transistor parameter. 3e. Explain with sketches the concept of the specified transistor biasing.	3.1 Unipolar and Bipolar devices 3.2 Symbol, construction and working principle of NPN transistor. 3.3 Transistor as switch and amplifier. 3.4 CE, CB and CC configurations. 3.5 Regions – Cut-off, saturation and Active region. 3.6 Transistor parameters- alpha, beta, input and output resistance and relation between alpha and beta 3.7 Transistor biasing- DC load line, Q-point and Fix bias and voltage divider biasing. 3.8 RC coupled amplifier.
Unit-IV Field Effect Transistors	4a. Explain with sketches the construction and working principle of the given type of FET. 4b. Determine the FET parameters from the given FET charasteristic curve. 4c. Describe the specified JFET paramenter. 4d. Describe the specified MOSFET paramenter.	4.1 FET-Types: JFET and MOSFET 4.2 Classification of JFET 4.3 Symbol, construction and working principle of N-channel and P-channel JFET, Drain and transfer characteristics of JFET 4.4 JFET parameters: DC and AC drain resistance, Transconductance, amplification factor 4.5 Symbol, construction and working principle of MOSFET.
Unit –V Sensors and Transducers	5a. Differentiate between the given type of sensor and transducer	5.1 Working of sensors and transducers 5.2 Selection criteria for transducers 5.3 Active and passive transducers

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	5b. Explain selection criteria of a transducer for the given application. 5c. Describe with sketches the working of photodiode and photo transistor as control device for the given application. 5d. Describe the steps to measure the temperature of a given metal using the given transducer.	5.4 Inductive, capacitive, resistive pressure and Piezoelectric transducer 5.5 Photodiode and phototransistor transducers 5.6 Thermocouple and Proximity sensors.

Note: To attain the COs and competency, above listed UOs 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	Electronic Components and Signals	08	02	04	06	12
II	Diodes and Their Applications	10	04	04	08	16
III	Bipolar Junction Transistor	14	04	06	08	18
IV	Field Effect Transistor	08	02	03	06	11
V	Sensors and Transducers	08	03	04	06	13
	Total	**48**	**15**	**21**	**34**	**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 UOs.. 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. Study of datasheet of electronic components.
c. Prepare charts of symbols of Electronic components.
d. Search information about Ratings and specifications of Regulator, diode transistors, CRO, function generator.
e. Collect information of analog and digital ICs and prepare charts of the same.
f. Collect information of passive transducers and prepare charts of the same.
g. Prepare posters to illustrate the use of photoelectric sensors in remote controls.

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. Guide students in preparing charts and display boards.
g. Guide students in searching information regarding datasheets and electronic components.
h. Show Video/Animation clippings for functioning of instruments.
i. 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 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. **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.
j. **Transistor as a switch:** Build / test transistor switch circuit on breadboard/General purpose PCB for various input signal.
k. **Use of sensors for driving relays / output devices:** Students will build/test circuit on breadboard/General purpose PCB. Verify output of designed circuit by appling different inputs.
l. **Prepare display boards consisting of electronic components**: prepare display boards/ models/ charts/ Posters to visualize the appearance of electronic active and passive components.

13. SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Electronic Instrumentation	Kalsi, H.S.	McGraw Hill Education, New Delhi,2010, **ISBN:** 978-0070702066
2	Electronics Principles	Malvino, Albert Paul, David	McGraw Hill Eduction, New Delhi, **ISBN:** 978-0070634244
3	A text book of Applied Electronics	Sedha, R.S.	S.Chand and Co. ,New Delhi, 2008,**ISBN** 978-8121927833
4	A course in electrical and electronic measurements and instrumentation	Sawhney, A.K.	Dhanpat Rai & Company, New Delhi, 2014 edition, **ISBN-:** 978-8177001006
5	Principles of Electronics	Mehta, V.K. Mehta, Rohit	S. Chand and Co. Ram Nagar, New Delhi-110 055, 11th Edition,2014 , ISBN 9788121924504

14. SOFTWARE/LEARNING WEBSITES

a. https://learn.sparkfun.com/tutorials/transistors
b. http://www.pitt.edu/~qiw4/Academic/ME2082/Transistor%20Basics.pdf
c. http://faculty.cord.edu/luther/physics225/Handouts/transistors_handout.pdf
d. http://www.technologystudent.com/elec1/transis1.htm
e. http://www.learningaboutelectronics.com/Articles/N-channel-JFET
f. http://www.electrical4u.com/jfet-or-junction-field-effect-transistor
g. www.nptel.com
h. http://www.electronics-tutorials