

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title : Semiconductor Devices Lab	Course Code : 15EC22P
Credits : 3 Credits	Semester : 2
Teaching Scheme in Hr. (L:T:P) : 0:2:4	Course Group : Core
Type of course : Tutorial + Practical	Total Contact Hours : 78
CIE : 25 Marks	SEE : 50 Marks

Prerequisites

Basic Knowledge of electronic components and devices theory

Course Objectives

Evaluate the operational characteristics of semiconductor devices

Course Outcomes

On successful completion of the course, the students will be able to

1. Identify various semiconductor devices.
2. Interpret the characteristics of semiconductor devices.
3. Apply the basic knowledge semiconductor devices for basic switching applications.
4. Select a right semiconductor device for a given application.
5. Observe and validate the functioning under simulated environment.
6. Develop a mini-project related to semiconductors and prepare a report on it.

Course Outcome		CL	Experiments linked	Linked PO	Teaching Hrs
CO1	Identify various semiconductor devices.	<i>R/U/A</i>	Unit 1, Expts 1 to 4	1,2,3,4,5,8,10	12
CO2	Interpret the characteristics of semiconductor devices-diode	<i>R/U/A</i>	Unit 1, Expts 5 to 7	1,2,3,4,5,8,10	09
CO3	Apply the basic knowledge semiconductor devices for basic switching applications.	<i>R/U/A</i>	Unit 1, Expts 8 to 11	1,2,3,4,5,8,10	12
CO4	Select a right semiconductor device for a given application.	<i>U/A</i>	Unit 1, Expts 12 to 16	1,2,3,4,5,8,9,10	15
CO5	Observe and validate the functioning under simulated environment.	<i>U/A</i>	Unit 1, Expts 17 to 20	1,2,3,4,5,8,9,10	12
CO6	Develop a mini-project related to semiconductors and prepare a report on it.	<i>U/A</i>	Unit 1, expt 21 & UNIT 2	1,2,3,4,5,8,9,10	12
Total sessions include two tests					78

Course-Po Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Semiconductor Devices Lab	3	3	3	3	3	--	--	3	1	3
<p>Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.</p> <p>Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO. If $\geq 40\%$ of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3 If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2 If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1 If $< 5\%$ of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.</p>										

Course Contents

UNIT – I: Tutorials and Graded Exercises Duration: 69Hr.

Sl. No.	Topic/Exercises	Duration (Hr.)
1.	Familiarization of precautions to be taken while using instruments like multimeter, ammeter, voltmeter, signal generator, CRO, Regulated power supply etc.	3
2	Identification of semiconductor devices and their leads like transistor, FET, DIAC, TRIAC, diode, UJT, SCR etc.	3
3	Testing of devices(diode, transistoretc) using multimeter	3
4	Familiarization of any simulation software (preferably open source)	3
5	Determination of knee voltage and forward dynamic resistance of a junction diode	3
6	Determination of the Reverse Characteristic curve of Zener diode	3
7	Demonstration of Zener diode as a voltage regulator	3
8	Determination of the input characteristics of BJT in CE configuration.	3
9	Determination of the output characteristics of BJT in CE configuration and calculation of ' β '.	3
10	Determination of the input characteristics of BJT in CB configuration.	3
11	Determination of the output characteristics of BJT in CB configuration and calculation of ' α '.	3
12	Determination of the reverse characteristics of a Photodiode.	3
13	Determination of the output characteristics of Photo Transistor.	3
14	Determination of the Transfer characteristics of enhancement MOSFET and determine threshold voltage	3
15	Demonstration of BJT as a switch to control LED	3
16	Demonstration of MOSFET as a switch to control LED	3

17	Determination of the V-I Characteristics of UJT.	3
18	Determination of the V-I Characteristics of SCR.	3
19	Determination of the V-I Characteristics of DIAC	3
20	Determination of the V-I Characteristics of TRIAC	3
21	One open-ended experiment of similar nature and magnitude of the above	3
	Two internal assessment	6
Total		69

UNIT – II: Project Activities [CIE- 05 Marks]

Duration: 9Hr.

Sl. No.	Activity	Duration (Hr.)
1	Collect specification and prepare charts displaying symbols of semiconductor devices (At least 10 devices and at least 10 variants in each category).	4
2	Open-ended activity like (i) Obtain characteristics of a diode under simulated environment and determine knee voltage, forward and reverse dynamic resistance and PIV. (ii) Create a circuit to blink two LEDs alternatively with a noticeable delay. (iii) Any other such activities that can contribute for the student's knowledge in respect of this course.	5
<p>Execution Mode</p> <ol style="list-style-type: none"> Maximum of 4 students in each batch for project activity. Project activity 1 and 2 are mandatory for every batch. Project activities shall be carried out throughout the semester and present the project report at the end of the semester. Report size shall be qualitative and not to exceed 10 pages; one report per batch. Each of the activity can be carried out off-class; however, demonstration/presentation should be done during laboratory sessions. Assessment shall be made based on quality of activity, presentation/demonstration and report. 		

References

1. *Electronics laboratory primer*, S. Poorna Chandra, B.Sasikala, S. Chand Technical Publication. ISBN 81-219-2459-6
2. *Fundamentals of Electronic Devices and Circuits Laboratory Manual*, David A. Bell Oxford University Press, ISBN 978-0-19-542988-6
3. *Electronic Devices*, Thomas L Floyd, ISBN10: 8177586432

Course Delivery

The course will be delivered through tutorials of two hours and four hours of hands on practice per week

Course Assessment and Evaluation Scheme

Method	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course Outcomes
DIRECT ASSESSMENT	CIE (Continuous Internal Evaluation)	IA Tests	Students	Two IA Tests (Average of two tests will be computed)	10	Blue books	1 to 6
				Record Writing (Average of Marks allotted for each experiment)	10	Record Book	1 to 6
				Mini Project	05	Report and Model	1 to 6
				TOTAL	25		
	SEE (Semester End Examination)	End Exam		End of the course	50	Answer scripts at BTE	1 to 6
INDIRECT ASSESSMENT	Student Feedback on course		Students	Middle of the course		Feedback forms	1 to 3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1 to 6 Effectiveness of Delivery of instructions & Assessment Methods

*CIE – Continuous Internal Evaluation

*SEE – Semester End Examination

Note:

1. I.A. test shall be conducted as per SEE scheme of valuation. However obtained marks shall be reduced to 10 marks. Average marks of two tests shall be rounded off to the next higher digit.
2. Rubrics to be devised appropriately by the concerned faculty to assess Mini Project/Student activities.

MODEL OF RUBRICS FOR ASSESSING STUDENT ACTIVITY

Dimension	Scale					Students exam Reg no/ Score				
	1.Unsatisfactory	2.Developing	3.Satisfactory	4.Good	5.Exemplary	Reg1	Reg2	Reg3	Reg4	Reg5
1.Research and gather information	Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	3				
2.Full fills teams roles and duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs almost all duties	Performs all duties of assigned team roles	2				
3.Shares work equality	Always relies on others to do the work	Rarely does the assigned work, often needs reminding	Usually does the assigned work, rarely needs reminding	Always does the assigned work, rarely needs reminding.	Always does the assigned work, without needing reminding	5				
4.listen to other team mates	Is always talking, never allows anyone to else to speak	Usually does most of the talking, rarely allows others to speak	Listens, but sometimes talk too much,	Listens and talks a little more than needed.	Listens and talks a fare amount	3				
TOTAL MARKS						13/4=3. 25=04				

Composition of Educational Components

Questions for CIE and SEE will be designed to evaluate the various educational components such as shown in the following table.

Sl. No.	Component	Weightage (%)
1	Remembering and Understanding	25
2	Applying the knowledge acquired from the course	35
3	Analysis	40

Scheme of Evaluation for End-exam

Sl. No.	Scheme	Max. Marks
1	Identification of semiconductor and their pins/ Testing of device functionalityetc.	05
2	Writing circuit diagram and procedure of one experiment	10
3	Conduction	20
4	Result	05
5	Viva-voce	10
TOTAL		50
Note:		
1. Candidate shall submit Lab record for the examination.		
2. Student shall be allowed to conduct directly even if she/he is unable to write the procedure.		

Laboratory Resource Requirements

Hardware Requirements:For a batch of 20 students.

Sl. No.	Equipment	Quantity
1	Dual Channel 0-30V at 2/1A RPS with short circuit protection	10
2	0-30V at 2/1A RPS with short circuit protection	10
3	Function Generator (0-10MHz)	10
4	Dual Trace Oscilloscope (=>20MHz).	10
5	Digital multimeters	20
6	Analog multimeters	10
7	Decade resistance boxes	10
8	Decade capacitance boxes	10
9	Decade inductance boxes	10
10	LCR meter	05
11	Electronic components –resistors, inductors, capacitors, transformers, hookup wires ,SCR,MOSFET, DIAC,TRIAC,BJT, Photo transistor, Photo diode, JFET, diode, Zener diode, soldering leadetc	L/S
12	Bread boards, Soldering Gun, Tag Board, 9V battery cells, Bulbs.	L/S

Model Questions for Practice and Semester End Examination

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Note: The questions are indicative but not exhaustive.

1. Determine the knee voltage and forward dynamic resistance of a given junction diode.
2. Experimentally determine the forward characteristics of a junction diode.
3. Determine the reverse Characteristics of a given Zener diode
4. Demonstrate how a Zener diode regulates voltage.
5. Determine the input characteristics of a given NPN transistor in CE configuration.
6. Demonstrate the method of determining output characteristics of a BJT in CE configuration and determination of ' β '.
7. Determine the output characteristics of a given BJT in CB configuration
8. Determine ' α ' of a given transistor with the help of an experiment
9. Determine ' β ' of a given transistor in with the help of an experiment.
10. Determine the reverse characteristics of a given Photodiode.
11. Determine the output characteristics of a given Photo Transistor.
12. Determine the transfer characteristics of a given MOSFET and its threshold voltage.
13. Demonstrate the use of BJT as a switch to control LED.
14. Show how an LED can be controlled using BJT.
15. Conduct an experiment to control the LED using MOSFET.
16. Sketch the V-I characteristics of a given UJT with the help of an experiment.
17. Show how gate current influences forward break over voltage of an SCR
18. Determine peak point and valley point voltages of a given UJT with the help of an experiment
19. Determine the V-I Characteristics of a given DIAC.
20. Determine the V-I Characteristics of a given TRIAC

End