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.

Course Contents

UNIT – I: Tutorials and Graded ExercisesDuration: 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 configurationandcalculation 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	Collectspecificationandpreparecharts 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**

Execution Mode

1. Maximum of 4 students in each batch for project activity.
2. Project activity 1 and 2 are mandatory for every batch.
3. Project activities shall be carried out throughout the semester and present the project report at the end of the semester.
4. Report size shall be qualitative and not to exceed 10 pages; one report per batch.
5. Each of the activity can be carried out off-class; however, demonstration/presentation should be done during laboratory sessions.
6. 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

Mapping Course Outcomes with Program Outcomes

Course outcomes	**Programme Outcomes**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	S	S		M								
2	S	S	S	S								M
3	S	S		S								
4	S	S	S	S								S
5	S	S	M	M	S	S	S	S			S	M

Legends-S: Strong Relationship M: Moderate Relationship.

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 4
				Record Writing(Average of Marks allotted for each experiment)	10	Record Book	1 to 4
				Mini Project	05	Report and Model	1 to 5
				TOTAL	25		
	SEE (Semester End Examination)	End Exam		End of the course	50	Answer scripts at BTE	1 to 4
INDIRECT ASSESSMENT	Student Feedback on course		Students	Middle of the course		Feedback forms	1 to 4, Delivery of course
	End of Course Survey			End of the course		Questionnaires	1 to 4, Effectiveness of Delivery of instructions & Assessment Methods

Note: IA test shall be conducted as per SEE scheme of valuation. However the obtained marks shall be reduced to 10 marks. Note: Any decimals shall be rounded-off to next higher digit.

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	40
2	Applying the knowledge acquired from the course	40
3	Analysis	10
4	Evaluation	05
5	Creating new knowledge	05

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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N**ote:** The questions are indicative but not exhaustive.

1. Determinetheknee voltage and forward dynamic resistance of a given junction diode.
2. Experimentallydetermine 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 CEconfigurationand 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 agiven transistor in with the help of an experiment.
10. Determine the reverse characteristics of a given Photodiode.
11. Determine the output characteristics ofagiven Photo Transistor.
12. Determine thetransfer characteristics of a given MOSFETandits threshold voltage.
13. Demonstrate the use of BJT as a switch to control LED.
14. Show how anLED 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