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

Course Title	:**POWER ELECTRONICS LAB**	Course Code	: **15EE55P**
Semester	:**V**	Course Group	: **Core**
Teaching Scheme (L:T:P)	: **0:2:4** (in Hours)	Credits	: **3 Credits**
Type of course	: **Tutorial + Practical**	Total Contact Hours	: **78**
CIE	: **25 Marks**	SEE	: **50 Marks**
Programme: ELECTRICAL AND ELECTRONICS ENGG.			

Pre-requisites	: Basic knowledge Analog electronics and Digital Electronics
Course Objectives	**:** To provide practical knowledge of power semiconductor devices and their applications

Course Outcomes:

On successful completion of the Course, the student will be able to:

1. Demonstrate the characteristics of power semiconductor devices.
2. Design firing circuit for Thyristors
3. Analyse the operation of converters.
4. Develop power semiconductor circuits to electrical power system
5. Construct power semiconductor circuits for industrial applications
6. Analyse power semiconductor circuits for domestic applications

List of Graded Experiments:

1. Design and conduct an experiment to plot the V –I characteristics of DIAC**.** **3 hrs**
2. Design and conduct an experiment to plot the forward biased V –I characteristics of SCR for different gate currents**.** **6 hrs**
3. Design and conduct an experiment to plot the V–I characteristics TRIAC in preferred turn on modes **6 hrs**
4. Construct R firing circuit and determine the maximum firing angle. **3 hrs**
5. Construct R – C firing circuit and determine the maximum firing angle. **3 hrs**
6. Construct and test UJT Relaxation oscillator **3 hrs**
7. Construct UJT firing circuit and determine the range of firing angle **3 hrs**
8. Construct a firing circuit using UJT and pulse transformer and trigger the SCR. **3 hrs**
9. Construct a single phase half controlled bridge converter for resistive load/DC motor. Trace the waveforms across SCR and load**.** **6 hrs**
10. Construct single phase full controlled bridge converter for resistive load. Trace the waveforms across SCR and load. **6 hrs**
11. Construct and test a Triac- fan motor speed control circuit **3 hrs**
12. Construct twilight relay using LDR and TRIAC **3 hrs**
13. Construct time delay relay using SCR and UJT. **3 hrs**
14. Construct and test a SCR battery charger circuit. **6 hrs**
15. Construct a simple circuit to use optocoupler as an SSR **3 hrs**
16. Construct AC static switch using SCR and observe the wave forms **3 hrs**

Reference Books:

1) Industrial Electronics and control by Dr S Chatterji
2) 24 SCR Projects – BPB Publications
3) SCR Manual – GEC
4) Industrial Electronics Test Lab Manual – Paul B Zbar

e-Resources:

www.electricalengineeringinfo.com/2014/06/silicon...

www.radio-electronics.com/info/circuits/scr-silicon.

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)
1	Remembering	20
2	Understanding	20
3	Application/ Analysis	60
Total		**100**

Mapping Course Outcomes with Program Outcomes:
(Course Outcome linkage to Cognitive Level)

Course Outcome		Experiment linked	PO Mapped	Cognitive Level	Lab Sessions
CO1	Demonstrate the characteristics of power semiconductor devices .	1, 2, 3	2	R/U	15
CO2	Design firing circuit for Thyristors	4,5,6,7,8	2,3,410	U/A	15
CO3	Analyse the operation of converters	9,10	2,3,4,10	U/A	12
CO4	Develop power semiconductor circuits to electrical power system	16	2,3,5,10	U/A	3
CO5	Construct power semiconductor circuits for industrial applications	11,12,13	2,3,5,10	U/A	9
CO6	Analyse power semiconductor circuits for domestic applications	14,15	2,3,10	U/A	9

U-Understanding; A-application/ Analysis; App-Application

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Power Electronics Lab	**-**	**3**	**3**	**3**	**1**	**-**	**-**			**3**

LEVEL 3- HIGHLY ADDRESSED, LEVEL 2-MODERATELY ADDRESSED, LEVEL 1-LOW ADDRESSED.

METHOD IS TO RELATE THE LEVEL OF PO WITH THE NUMBER OF HOURS DEVOTED TO THE COS WHICH ADDRESS THE GIVEN PO.

IF ≥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.

Course Delivery:

The laboratory Course will be delivered through Tutorial, laboratory interaction, practical exercises, instructions, assignments and viva voice.

Tutorial - 1Hr:

Staff-in-charge will;

1. Explain the concept and working of experiment to be conducted.
2. Impart/ discuss required selection of ICs/ components/ devices/ meters /equipment / suitable accessories for the experiment to be conducted.
3. Ask students to draw the circuit diagram, tabular column ,typical Graphs and waveforms
4. Give clear instructions about safety precautions to be followed while conducting the experiment.

Conduction/ Execution- 2 Hr:

Student will rig up the circuit diagram on bread board and conduct experiment individually under the supervision of the staff-in-charge.

Course Assessment and Evaluation:

	What		To Whom	Frequency	Practical	Evidence Collected	Course Outcomes
Direct Assessment Method	CIE (Continuous Internal Evaluation)	I A Tests	Students	Two IA tests for Practical (Average marks of both the tests)	10	Blue Books	1 to 6
		Record Writing		Record Writing (Average of Marks allotted for each experiment.)	10	Lab Record	1 to 6
				Student Activity	05	3 pages Report	1 to 6
				TOTAL	**25**		
	SEE (Semester End Examination)	End Exam	Students	End of the Course	50	Answer Scripts	1 to 6
Indirect Assessment Method	Student Feedback on course		Students	Middle of The Course	Feed Back Forms		1 to 6
	End of Course Survey			End of The Course	Questionnaire		1 to 6

*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 Student activities.

Suggested Student Activity (any one to be submitted with 3 pages report):

1 Study data sheet of various power semiconductor devices
2 Identify various power electronic components and method of testing
3 Construct a digital firing circuit for converters
4 Disassembling and assembling , identify the circuits in UPS
5 Disassembling and assembling , identify the circuits of a relay type stabilizer
6 Disassemble, identify the circuits and assemble servo –controlled stabilizer
7 Determine the rating of UPS according to customer requirement
8 Construct temperature controller using triac
9 Study of single phase PWM inverter.
10 Study of BLDC motor
11 Study of Buck-boost converters

MODEL OF RUBRICS / CRITERIA FOR ASSESSING STUDENT ACTIVITY (Course Coordinator)

Dimension	Scale					Students score (Group of five students)				
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	1	2	3	4	5
1	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	3				
2	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2				
3	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	5				
4	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	4				
Note: Concerned faculty (Course coordinator) must devise appropriate rubrics/criteria for assessing Student activity for 5 marks **One activity on any one CO (course outcome) may be given to a group of FIVE students** **Grand Average/Total**						14/4 =3.5 ≈4				

Example only: MODEL OF RUBRICS / CRITERIA FOR ASSESSING STUDENT ACTIVITY-
Task given- Industrial visit and report writing

Dimension	Scale					Students score (Five students)				
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	1	2	3	4	5
1.Organisation	Has not included relevant info	Has included few relevant info	Has included some relevant info	Has included many relevant info	Has included all relevant info needed	3				
2. Fulfill team's roles & duties	Does not perform any duties assigned	Performs very little duties	Performs partial duties	Performs nearly all duties	Performs all duties of assigned team roles	2				
3.Conclusion	Poor	Less Effective	Partially effective	Summarises but not exact.	Most Effective	5				
4.Convensions	Frequent Error	More Error	Some Error	Occasional Error	No Error	4				
					Total marks	14/4=3.5 ≈4				

Scheme of Valuation for SEE (Semester End Examination):

Sl. No.	Particulars	Marks
1.	Writing Circuit diagram and Procedure	10
2.	Circuit connection	10
3.	Conduction	10
4.	Results	10
5.	Viva-Voce	10
Total		**50**

Model Question Bank:

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2. Design and conduct an experiment to plot the V –I characteristics forward biased SCR for different gate currents.
3. Design and conduct an experiment to plot the V –I characteristics TRIAC in preferred turn on modes
4. Construct R firing circuit and determine the maximum firing angle.
5. Construct R –C firing circuit and determine the maximum firing angle
6. Construct and test UJT Relaxation oscillator
7. Construct UJT firing circuit and determine the range of firing angle
8. Construct a firing circuit using UJT and pulse transformer and trigger the SCR
9. Construct single phase half controlled bridge converter for resistive load. Trace the waveforms across SCR and load.
10. Construct single phase full controlled bridge converter for resistive load. Trace the waveforms across SCR and load.
11. Construct and test a Triac - fan motor speed control circuit.
12. Construct twilight relay using LDR and TRIAC .
13. Construct time delay relay using SCR and UJT.
14. Construct and test a SCR battery charger circuit.
15. Construct a simple circuit to use optocoupler as an SSR.
16. Construct ac static switch using SCR and observe the wave forms.

POWER ELECTRONICS Lab Equipments Requirement:

Students Intake : 60
Students per Batch : 20

Sl. No.	Name of Equipment and Specification	Quantity Required
1.	DC Regulated power supply (0-300V, 2A)	10
2.	DC Regulated Dual power supply (0-30V,2A)	10
3.	Cathode Ray Oscilloscope- Dual trace, 25 MHz.	10
4.	Digital Multimeter- $3^1/_2$”	20
5.	Table fan 230V , 60 w	20
6.	Battery 6 V/12 V 60 AH	20