SEMESTER S4

POWER ELECTRONICS AND APPLICATIONS

Course Code	**PEBMT 411**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3-0-0-0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	PE

Course Objectives:

1. The purpose of learning this course is to describe various power electronic devices so that the learner will be able to meet technical demands concerning power electronics and its applications.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Introduction to Power Electronics-**Scope and applications-power electronics vs signal electronics. **Power electronics devices-** Power diodes, Power transistors, MOSFETS and IGBTs. Structure, fabrication, Regions of operations, switching characteristics, Safe operating area. **Thyristor family**: SCRs, VI characteristics, dynamic characteristics, turn-on methods, thyristor protection, two transistor analogy, latching current and holding current. DIAC and TRIAC (basic concepts only)	**9**
2	**AC-DC converters**: Single phase-controlled rectifiers – half wave, full-wave, half-controlled and fully controlled with R, RL and RLE with freewheeling diodes-typical waveforms and output equations. Three phase half-wave and full-wave controlled rectifier with R load-typical waveforms and output equations	**9**
3	**DC-DC converters**: Step down and step-up choppers –classification, time ratio control & current limit control in dc-dc converters, Buck, Boost and Buck-Boost converters.	**9**

KTU SPECIAL

	DC-AC Inverters, Square wave operations, single-phase half bridge and full bridge inverters with R and RL loads, three-phase bridge inverter with R load- 120° and 180° conduction modes, Carrier based unipolar and bipolar PWM inverters, Effect of harmonics and its elimination, Sinusoidal PWM inverters.	
4	Gate driver circuits-Isolated and non-isolated types, Applications-residential and industrial applications, SMPS-flyback converter, push-pull converter, half-bridge converter and full bridge converter, static switches-single phase AC switches and DC switches, solid state relays- AC and DC solid state relays, microelectronic relays.	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Micro project	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

KTU SPECIAL

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Describe basic operation and compare performance of various power semiconductor devices.	**K1, K2**
CO2	Analyze the performance of power converter circuits	**K3 ,K4**
CO3	Design and implement chopper circuits suitable for various applications.	**K3**
CO4	Describe the working of various types of inverters including PWM inverter.	**K2**
CO5	Implement various drive circuits and application of power electronics	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2		1							2
CO2	3	3	2		1							2
CO3	3	3	3		1							2
CO4	3	3	1		1							2
CO5	3	3	3		1		2					2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

KTUSPECIAL

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Power Electronics - Essentials and applications	L. Umanand	Wiley	2009
2	Power Electronics Circuits, Devices and Applications	Muhammad H. Rashid	Pearson Education	4th edition, 2013
3	Power Electronics	Dr. P. S. Bimbhra	Khanna Publishers	2012
4	Power Electronics	M.D. Singh, K.B. Khanchandani	TataMcgraw Hill	3rd edition, 2008

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Power electronics: converters, applications, and design	Ned Mohan, Tore M. Undeland	John Wiley & Sons	1989
2	Power Electronics.	Daniel. W. Hart	Pearson Education	2010

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://youtube.com/playlist?list=PLTFstmhqwXp-OEjDuBKmaPac-qJzdfvol&si=ayJx_RL7unspjbsa
2	https://archive.nptel.ac.in/courses/108/105/108105066/
3	https://youtube.com/playlist?list=PLwdnzlV3ogoWVgA9fHBV36L_bxWZlpa7X&si=tBAT_LFK2SmeUBY1
4	https://youtu.be/tI2OJWOQSTg?si=LKrRWYMf3FiGlKf6

KTU SPECIAL