Academic Course Description

BHARATH UNIVERSITY

Faculty of Engineering and Technology

Department of Electrical and Electronics Engineering

BEE502 POWER ELECTRONICS

Fifth Semester (Odd Semester)

Course (catalog) description:

To enable the students to gain a fair knowledge on characteristics and applications of power electronic devices and circuits

Compulsory/Elective course **:** Compulsory for EEE students

Credit hours&contact hours : 3 &45 hours

Course Coordinator : Mrs. S. Sherine

Instructors **:** Mrs. S. Sherine

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@ bharathuniv.ac.in	Consultation
Mrs.Sherine	Third year EEE	KS 302	04422290125	Sherine07@gmail.com	12.30 PM - 1.30 PM

Relationship to other courses:

Pre –requisites **:**BEE303 (Electron Devices)

Assumed knowledge :The students will already have the basic knowledge about the electronic devices.

Following courses : Electrical Drives and Control

Syllabus Contents

UNIT I POWER SEMICONDUCTOR DEVICES 9

Construction, Principle of operation Power diodes , power transistors SCR, TRIAC, GTO, MOSFET, IGBT – driver circuit, turn – on method – commutation series and parallel connections

UNIT II PHASE CONTROLLED CONVERTERS 9

Converter inverters operation – Single phase and three phase controlled rectifiers(half and full converters) with R,RL and RLE load effect of source inductance and firing circuits – Dual converters – single phase & three phase dual converters

UNIT III DC TO DC CHOPPER 9

Voltage, current load commutated chopper – step-up chopper and firing circuits – one, two and four quadrant chopper application to DC driving control

UNIT IV INVERTERS 9

Series inverter – parallel inverter – current source inverter – voltage source inverter - Modified McMurray, auto sequential inverter– PWM inverter – UPS.

UNIT V AC CHOPPER,CYCLOCONVERTER&VOLTAGE CONTROLER 9

Single phase AC chopper, multistage sequence control – step up and step down cyclo-converter – three phase to single phase and single phase to three phase cyclo-converter – triggering circuit based on micro controller – single phase AC voltage controller with R, RL, RLE.

Text book(s) and/or required materials:

T_1:P.S. Bhimbra "Power Electronics", Khanna publishers
T_2:Singh, "Power Electronics", TMH New Delhi.
T_3:Rashid M.H. "Power Electronics circuits, Devices and application" Prentice Hall International 1995.

Reference Books:

R_1: Sen P.C. "Power Electronics". TMH, New Delhi.
R_2: Lander. W, "Power Electronics", McGraw Hill.
R_3:http://www.ni.com/tutorial/14674/en/

Computer usage: Matlab

Professional component

General	-	0%
Basic Sciences	-	0%

Engineering sciences & Technical arts	-	0%
Professional subject	-	100%

Broad area :Circuit Theory | Electrical Machines| **Electronics** | Power System| Control &Instrumentation

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	August 1st week	Session 1 to 18	2 Periods
2	Cycle Test-2	September 2nd week	Session 19 to 36	2 Periods
3	Model Test	October 2nd week	Session 1 to 45	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

To enable the students to gain a fair knowledge on characteristics and applications of power electronic devices and circuits.	Correlates to program outcome		
	H	**M**	**L**
CO1: To learn the characteristics of different types of power electronic devices.	a	e	f
CO2:. To understand the operation of controlled rectifiers.	a	e	f
CO3: To understand the operation of choppers & its types.	a	e	f
CO4: To understand the operation of inverters & its types.	a	e	f
CO5: To learn the operation of AC chopper, cyclo-converter and voltage controller.	a	e	f

H: high correlation, M: medium correlation, L: low correlation

Draft Lecture Schedule:

S.NO	Topics	Problem solving (Yes/No)	Text / Chapter
UNIT I	**POWER SEMICONDUCTOR DEVICES**		
1.	Construction & Principle of operation of Power diodes	**No**	**[T_1]**
2.	Construction & Principle of operation of power transistors	**No**	
3.	Construction & Principle of operation of SCR	**No**	
4.	Construction & Principle of operation of TRIAC	**No**	
5.	Construction & Principle of operation of GTO	**No**	
6.	Construction & Principle of operation of MOSFET	**No**	
7.	Construction & Principle of operation of IGBT	**No**	
8.	Driver circuit, turn On method, Commutation circuits	**No**	
9.	Series and parallel connections.	**No**	
UNIT II	**PHASE CONTROLLED CONVERTERS**		
10.	Converter & inverter operation	**No**	**[T_1] / [T_3]**
11.	Single phase half controlled rectifiers with R, RL and RLE	**No**	
12.	Three phase full controlled rectifiers with R, RL and RLE load.	**No**	
13.	Single phase Full controlled rectifiers with R, RL and RLE	**No**	
14.	Three phase full controlled rectifiers with R, RL and RLE	**No**	
15.	Effect of source inductance	**No**	

16.	Single phase dual converters	**No**	
17.	Three phase dual converters	**No**	
18.	Basic problems	Yes	
UNIT III	**DC TO DC CHOPPER**		
19.	Voltage commutated chopper	**No**	**[T_1] / [T_3]**
20.	Current commutated chopper	**No**	
21.	load commutated chopper	**No**	
22.	Commutation circuits	**No**	
23.	Step-up chopper	**No**	
24.	Step-down chopper	**No**	
25.	One quadrant chopper application to DC driving control	**No**	
26.	Four quadrant chopper application to DC driving control	**No**	
27.	Review of UNIT III	**No**	
UNIT IV	**INVERTERS**		
28.	Series inverter	**No**	**[T_1] / [T_3]**
29.	Parallel inverter	**No**	
30.	Current source inverter	**No**	
31.	Voltage source inverter	**No**	
32.	Modified McMurray inverter	**No**	
33.	auto sequential inverter	**No**	
34.	PWM inverter	**No**	
35.	UPS	**No**	
36.	Review of UNIT IV	**No**	
UNIT V	**AC CHOPPER,CYCLOCONVERTER&VOLTAGE CONTROLER**		

37.	Single phase AC chopper	**No**	**[T_1]**
38.	Multistage sequence control	**No**	
39.	Step up and step down cyclo-converter	**No**	
40.	Three phase to single phase cyclo-converter	**No**	
41.	Single phase to three phase cyclo-converter	**No**	
42.	Triggering circuit based on micro controller	**No**	
43.	Single phase AC voltage controller with R, RL	**No**	
44.	Single phase AC voltage controller with RL	**No**	
45.	Review of UNIT V	**No**	

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.
- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	05%
Cycle Test – II	-	05%
Model Test	-	10%
Attendance	-	05%
SEMINAR&ASSIGNMENT	-	05%
Final exam	-	70%

Prepared by: **Dated :**

Mrs. S. Sherine

Addendum

ABET Outcomes expected of graduates of B.Tech / EEE / program by the time that they graduate:

a) An ability to apply knowledge of mathematics, science, and engineering fundamentals.
b) An ability to identify, formulate, and solve engineering problems.
c) An ability to design a system, component, or process to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d) An ability to design and conduct experiments, as well as to analyze and interpret data.
e) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
f) An ability to apply reasoning informed by the knowledge of contemporary issues.
g) An ability to broaden the education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
h) An ability to understand professional and ethical responsibility and apply them in engineering practices.
i) An ability to function on multidisciplinary teams.
j) An ability to communicate effectively with the engineering community and with society at large.
k) An ability in understanding of the engineering and management principles and apply them in project and finance management as a leader and a member in a team.
l) An ability to recognize the need for,and an ability to engage in life-long learning.

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Program Educational Objectives

PEO1: PREPARATION

Electrical Engineering Graduates are in position with the knowledge of Basic Sciences in general and Electrical Engineering in particular so as to impart the necessary skill to analyze and synthesize electrical circuits, algorithms and complex apparatus.

PEO2: CORE COMPETENCE

Electrical Engineering Graduates have competence to provide technical knowledge, skill and also to identify, comprehend and solve problems in industry, research and academics related to power, information and electronics hardware.

PEO3: PROFESSIONALISM

Electrical Engineering Graduates are successfully work in various Industrial and Government organizations, both at the National and International level, with professional competence and ethical administrative acumen so as to be able to handle critical situations and meet deadlines.

PEO4: SKILL

Electrical Engineering Graduates have better opportunity to become a future researchers/ scientists with good communication skills so that they may be both good team-members and leaders with innovative ideas for a sustainable development.

PEO5: ETHICS

Electrical Engineering Graduates are framed to improve their technical and intellectual capabilities through life-long learning process with ethical feeling so as to become good teachers, either in a class or to juniors in industry.

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Course Teacher	Signature
Mrs. S. Sherine	

Course Coordinator **HOD/EEE**

(Mrs. S. Sherine) ( )