GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: APPLIED POWER ELECTRONICS
(COURSE CODE: 3352402)

Diploma Programme in which this course is offered	Semester in which offered
Power Electronics	5th Semester

1. RATIONALE

With the advancement of technology application of Power electronics are increasing day by day. This course is intended to enable the students to understand the facts, concepts and principles of the advance applications of high frequency heating, resistance welding, ultrasonic and timers. This will enable him/her in designing, operating and maintaining electric circuits. These skills developed through this course will help the student to function confidently in his/her career. It is also aimed to expose students to some of the advanced techniques used in the modeling, analysis and design of modern power electronic systems.

2. LIST OF COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competency:

Operate and maintain industrial applications based on high frequency.

3. COURSE OUTCOMES (COs)

The theory should be taught and practical should be undertaken in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domains to demonstrate the following course outcomes:

  i.   Test Solid state relay like time delay relay using SCR and UJT, DIAC and TRIAC
  ii. Test different industrial applications of Opto electronic devices.
  iii. Test different high frequency heating.
  iv. Apply various resistance welding techniques
  v.   Describe properties, generation and applications of ultrasonic waves.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	
3	0	2	5	70	30	20	30	150

Legends: L - Lecture; **T -** Tutorial/Teacher Guided Student Activity; **P -** Practical;   **C -** Credit; **ESE** - End Semester Examination; **PA** - Progressive Assessment

5. COURSE DETAIL

Unit	Major Learning Outcomes (Major outcomes in cognitive domain)	Topics and Sub-topics
Unit – I Relays and Timers	1a. Describe construction of solid state relays 1b. Describe the working of solid state relay circuits 1c. State merits of solid state relay	1.1 Solid state relays, Merits of solid state relay over electromechanical relay
	1d. Explain working of time delay relay with its applications 1e. Explain working of sequential timer with its applications	1.2 time delay relay, sequential timer 1.3 Applications of IC 555, IC556
Unit – II Industrial Applications of Opto-Electronic Devices	2a. Explain the working of various photo electric devices such as LDR, photo cell, photo diode, photo transistor, LASCR	2.1. Photo electric devices: LDR, photo cell, photo diode, photo transistor, LASCR
	2b. Explain the working of Photo relay circuit using Opto-couplers	2.2. Opto-couplers 2.3. Photo relay circuit 2.4. Opto-coupler-with photo diode, photo transistor, SCR driver, TRAIC driver, FET driver
Unit – III Industrial Heating	3a. Explain working of induction heating 3b. Derive equation of depth of penetration 3c. Solve numerical problems related to induction heating	3.1. Induction heating: Principle of working, depth of penetration, factor effecting depth of penetration, characteristics, simple numerical problems 3.2. Merits and limitations of induction heating. 3.3. Applications of induction heating
	3a. Explain the working of dielectric heating 3b. Solve simple numerical problems related to dielectric heating 3c. Compare major features of induction and dielectric heating	3.5. Dielectric heating 3.6. Equation for power density, numerical problems 3.7. Comparison of induction and dielectric heating
Unit – IV Resistance Welding Devices	4a. Describe concept of resistance welding 4b. Describe the block diagram of resistance welding with the help of welding cycle	4.1. resistance welding : concept, resistance welding cycle, working
	4c. Describe working of different resistance welding methods	4.2. spot welding, projection welding, seam welding, butt welding
	4d. Different between synchronous and non-synchronous control	4.3. synchronous and non-synchronous control

Unit	Major Learning Outcomes (Major outcomes in cognitive domain)	Topics and Sub-topics
	4e. Distinguish between AC and DC welding 4f. Differentiate between single phase and three phase welding	4.4. AC welding: single phase and three phase welding 4.5. DC welding
	4g. Describe the use of timer used in welding process	4.6. Sequence timer
	4h. Explain working of electronic line contactor	4.7. Electronic line contactor, its advantages over electro-mechanical line contactor
	4i. Explain working of heat control circuit	4.8. Heat control circuit
	4j. Describe the concept of Energy storage welding 4k. Comnpare the features of Capacitor type energy storage welding system and inductor type energy storage welding system	4.9. Capacitor type energy storage welding system, inductor type energy storage welding system
Unit – V **Ultrasonic** **Devices**	5a. Describe concept of properties of Ultrasonic waves 5b. Describe the production of Ultrasonic waves	5.1. Ultrasonic waves
	5c. Explain the concept of piezo electric generation 5d. Describe the working of magnetostrictive generator circuit	5.2. Piezo-electric generator, Magenetostrictive generator Circuit,
	5e. Describe the working of various ultrasonic devices such as Ultrasonic flow measurement, Ultrasonic flow detector Ultrasonic welding, Ultrasonic cleaner and others	5.3. Ultrasonic flow measurement, Ultrasonic welding, Ultrasonic cleaner, Ultrasonic flow detector,

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (Theory)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Relays and Timers	8	2	2	8	12
II	Industrial Applications of Opto-Electronic Devices	10	2	6	10	18
III	Industrial Heating	8	1	6	7	14
IV	Resistance Welding Devices	12	1	7	10	18
V	Ultrasonic Devices	4	2	2	4	10
	Total	42	8	23	39	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

7.   SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills *(outcomes in psychomotor and affective domain)* so that students are able to acquire the competencies/course outcomes. Following is the list of practical exercises for guidance.

*Note: outcomes in psychomotor domain are listed here as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical/Exercise (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
1.	I	Build /Test solid state relay using SCR & UJT for DC load	2
2.	I	Build/Test solid state relay using SCR & UJT for AC load	2
3.	I	Build /Test solid state relay using DIAC & TRIAC	2
4.	I	Build /Test timer circuit using IC 555	2
5.	II	Build /Test Light operated relay using LDR & Transistor	2
6.	II	Build/Test Light Interrupted relay using LDR &	2

S. No.	Unit No.	Practical/Exercise (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
		Transistor	
7.	II	Build /Test Light operated relay using LDR & IC 555	2
8.	II	Build /Test Liquid level controller	2
9.	II	Build /Test temperature control circuit	2
10.	II	Build /Test delayed automatic power ON/OFF	2
11.	III	Use induction heating for different applications	2
12.	III	Use dielectric heating for different applications	2
13.	IV	Use of sequential weld control circuit	2
14.	V	Use of Ultrasonic transmitter and receiver for different applications	2
Total			**28**

8.   SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like:

i.   Students have to find practical applications of different circuits in home appliances and have to list various parameters of those applications.

ii.   Students are instructed to list various practical applications

iii.   Students are instructed to take any one applications

9.   SPECIAL INSTRUCTIONAL STRATEGY (if Any)

i.   Arrange Expert Lectures especially from relevant industries.

ii.   Show animation/flash/videos for explaining different advance applications.

iii.   Give mini project related with industrial applications and house hold applications

10.   SUGGESTED LEARNING RESOURCES

A. List of Books

S. No.	Title of Books	Author	Publication/Year
1.	Industrial electronics	Biswas S.N.	Dhanpat Rai and Co.(P) Ltd, New Delhi, Latest edition
2.	Industrial electronics	Mithal G. K.	Khanna publisher, New Delhi, Latest edition
3.	Industrial Electronics and Control	Bhattacharya S. K Chetterjee S.	Tata McGraw-Hill Publishng Co. Ltd. New Delhi, Latest edition, Eleventh reprint
4.	Industrial electronics	Kissell, Thomos E.	Printice hall of India, New Delhi, 3rd edition

B. List of Major Equipment/Materials

i.   Digital multi meter

ii.   Digital Oscilloscope

iii.   Various Trainer boards

    iv. Various electronic components

    v. Any one simulation software

C. Learning Websites/ List of Software

    i. http://freevideolectures.com/Course/2351/Power-Electronics

    ii. http://www.electronics-tutorials.ws/

    iii. http://educypedia.karadimov.info/electronics/electronicaopening.htm

    iv. http://en.wikipedia.org/wiki/Power_electronics

    v. PSIM

    vi. ORCAD

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Smt. J.M. Patel**, ALPE, Dept. of Power Electronics, Dr. S. & S. S. Ghandhy College of Engg. and Technology, Surat
- **Prof. S. A. Patel**, LPE, Dept. of Power Electronics, Dr. S. & S. S. Ghandhy College of Engg. and Technology, Surat

Coordinator and Faculty Members from NITTTR Bhopal

- **Prof. A. S. Walkey**, Associate Professor, Dept. of Electrical & Electronics Engg,
- **Dr. Joshua Earnest**, Professor, Dept. of Electrical & Electronics Engg,