

GUJARAT TECHNOLOGICAL UNIVERSITY
BIOMEDICAL ENGINEERING (03)
ELECTRONICS SYSTEM DESIGN
SUBJECT CODE: 2180308
B.E. 8th Semester

Type of course: Department Elective - I

Prerequisite: Analog circuits, electronics workshop, Circuit & Network

Rationale: This subjects covers basics concepts of power electronics & Electromagnetic compatibility and their issues. Contents of subjects is selected on the basis of real field requirements of biomedical design related projects.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		PA (V)		PA (I)		
				PA	ALA	ESE	OEP			
4	0	2	6	70	20	10	20	10	20	150

Content

Sr. No.	Content	Total Hrs.	% Weightage
1	Electro mechanical energy conservation: Principle of electro mechanical energyconservation, Use of magnetic for energy conservation, Analysis of simple magneticcircuit, Magnetic system with mechanical motion, Electromagnetic & Solid staterelay, Case study; Solenoid design, Servo motor construction and application	05	14
2	Step motor: PM, VR & hybrid Step motor, its construction, its relative merits anddemerits. Static & dynamic torque speed characteristics, Half step & micro stepping.	04	10
3	Power Electronics: Overview, Types of Power Diodes, Diodes with various Loads, Freewheeling Diodes, and Performance Parameters of Rectifiers, Power BJTs, Power MOSFETs, IGBTs, MOSFET Gate and BJT BaseDrive Circuits, Isolation of Base & Gate Drive Circuits.	08	20
4	Thyristor: Characteristics, Two Transistor model of Thyristor, Thyristor Turn-On, Thyristor Turn-Off, Types of Thyristors, Series & Parallel Connections of Thyristors & Gate drive circuits.	06	15
5	Inverters: Principal of Operation of Pulse Width Modulated Inverters, PerformanceParameters, Single Phase Bridge Inverters, Current Source Inverter, Series ResonantInverter, Parallel Resonant Inverter, Class E Resonant Inverter, Multilevel InverterConcept, Applications & features of Multilevel Inverter.	06	15
6	Converters: Principal of Step Down Converter, Principle of Step UP Converter,Performance Parameters, Converter Classification, Switch Mode Buck, Boost andBuck-Boost Regulators, UPS as AC Power Supply.	06	10
7	Electromagnetic Compatibility: Grounding: Introduction, Safety grounds, Signal grounds, Common Impedance coupling, Hybrid grounds and ground	10	16

	loops. Cabling: Effect of shield on capacitive coupling, Effect of shield on Magnetic coupling, Co-axial cable vs twisted pair cable. Balancing & Filtering: Balancing, filtering, Power Supply decoupling.		
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Reference Books:

No.	Title of Books	Author	Publication
1	Power Electronics Circuits, Devices and Applications, 3rd Edition.	Rasid, Muhammad, H.	PHI & Pearson Education
2	Power Electronics	Singh., M., D., &Khanchandani, K., B.	TMH Publications
3	Power Electronics	Asghar, Jamil, M. S.,	PHI Publications
4	Electromagnetic Compatibility Engineering,	H W Ott, John Wiley & Sons,2009	John Wiley & Sons,

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
10%	35%	30%	15%	10%

Course Outcome:

After completion of course students will be able to

1. Apply the principal of electromechanical energy conservation.
2. Classify and justify need of various types of step motor.
3. Apply various power electronics devices
4. Understand principal and operation of various Inverters and converters.
5. Understand need and effects of shielding, Grounding on circuits.

List of Experiments:

		Planned Hours
1	To study SCR Characteristics	02
2	To study various SCR Turn ON methods	02
3	To study Forced Commutation Circuit Class A,B,C,D,E	02
4	To study Switching Characteristic of Power MOSFET	02
5	To study operation of Single Phase Series Inverter	02
6	To study operation of Single Phase Parallel Inverter SCR Control	02
7	To study crosstalk controlling- Frequency/time domain perspectives.	02
8	To study RF spectrum of radiated source (like motor) is ON and OFF using RF analyzer	02

Design based Problems (DP)/Open Ended Problem:as per topics of syllabus.

Active Learning Assignments: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding of theory and practical work. The faculty will assign topics from which students can grasp knowledge about current scenario of the virtual biomedical Instrumentation. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.