GUJARAT TECHNOLOGICAL UNIVERSITY

SUBJECT: POWER ELECTRONICS AND DRIVES

SUBJECT CODE: 2164104

B.E. 6th Semester

Type of course: Professional Core Course

Prerequisite: Basic Electronics and Concept of DC Machines

Rationale: The course is aimed to act as a foundation block and to provide exposure about various aspects (construction, characteristics, operation, ratings etc.) of power electronic devices. It also covers power electronic converters that provide variable DC voltage.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	1	0	4	70	20	10	20	10	20	150

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

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	**Power Semiconductor Devices And Characteristics:** Operating principle and switching Characteristics: Power diodes, Power BJT, Power MOSFET, IGBT, SCR, TRIAC, GTO, MCT, Power integrated circuits (PIC) – Drive and Protection circuits – Series and parallel operation – Commutation – Simulation tools.	9	20%
2	**Controlled Rectifiers And Ac Controllers:** Single phase – Three phase – Half controlled – Fully controlled rectifiers – Dual converters -Effect of source and load inductance - AC voltage controllers –Introduction to Cycloconverters, Matrix converters	9	20%
3	**DC To DC Converters:** Step up and Step down Chopper – Chopper classification - quadrant of operation – Switching mode Regulators – Buck, Boost, Buck-Boost, and Cuk Regulators.	9	20%
4	**Inverters:** Voltage source Inverters – Half bridge – Full bridge – Three Phase Bridge Inverters – Voltage control– PWM Techniques – Current Source Inverters: Capacitor Commutated Inverter- Resonant inverters: Series, Parallel, ZVS, ZCS – Introduction to multilevel Inverters.	9	20%

5	**Drives And Control:** Static and Dynamic equations of dc and ac machines – Electrical breaking – Rectifier and chopper control of DC drives – Principles of v/f control of AC drives – Open loop and Closed loop schemes for DC and AC drives(Block diagram approach only) – Introduction to vector control of AC drives.	9	20%

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
25%	**50%**	**25%**	**-**	**-**	**-**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's 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.

Reference Books:

1. Rashid, M.H., "Power Electronics – Circuits, Devices and Applications", PHI, 3rd Edition, 2004.
2. Mohan, Udeland and Robbins., "Power Electronics", John Wiley and Sons, New York, 1995.
3. Singh, M.D., and Khanchandani, K.B., "Power Electronics", 2nd Edition., Tata McGraw-Hill, 2011.
4. Bose, B.K., "Modern Power Electronics and AC Drives", Pearson Education, 2002.
5. Bimbra, P.S., "Power Electronics", Khanna Publishers, 2006.
6. Moorthi, V.R., "Power Electronics - Devices, Circuits and Industrial Applications", Oxford University Press, 2005.

Course Outcomes:

1. Ability to explain various devices and their structure, operating characteristics in the field of electronics.
2. Ability to classify, analyze and design, Control rectifier, chopper and inverter.
3. Will have ability to apply power electronic circuits for the control of popular applications.
4. Exposure to design and analyze PE circuit using simulation software.

List of Tutorials:

1. To understand about power MOSFET.
2. To understand about power IGBT.
3. To study about half controlled and fully controlled rectifier.
4. To study about A.C. voltage controller.
5. To understand the various technique of DC to DC converters.
6. To understand about various method of inverters.
7. To understand the constructional features of A.C. & D.C. drive system.

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. 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.