FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **Bachelor of Technology (Electrical Engineering)**

Semester: **V**

Course Code: **202050504**

Course Title: **Power Electronics and Drives- I**

Course Group: **Professional Core Course -VI**

Course Objectives: To provide a general overview Power electronics device, principle operation and control of AC and DC, DC to DC Converter and its applications

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	0	2	4	50 / 18	50 / 17	25/9	25 / 9	150 / 53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Introduction** Overview of power electronic converters and their applications. Power Semiconductor Devices, Classifications, construction, characteristics, datasheet interpretation, Gate driver circuits, isolation and protection circuits.	06
2	**AC to DC Converter :** Single Phase AC to DC Converters: Half, Semi and full wave Controlled Rectifiers with R, RL and RLE loads, Continuous, discontinuous and inversion mode of operation, Performance parameters, Three Phase AC to DC Converter : Three Phase Half Wave and Full Wave Controlled Rectifier with R, RL, RLE loads, Dual Converter with circulating and non-circulating current mode, Effect of source inductance in controlled rectifiers, Power factor improvement techniques, Applications of AC-DC converters, Introduction to PWM rectifiers.	14

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3	**DC to DC Converter :** Importance & Requirement of DC Power Supply, Non-Isolated DC-DC converters, Principles of step-down and step-up converters, Continuous conduction and Discontinuous conduction operation – classification of chopper, Control strategy, Buck, Boost, Buck-boost, Steady state time domain analysis, voltage, current and load commutated choppers, Chopper configurations: Voltage Commutated, Current Commutated, Load Commutated Chopper ,SEPIC & ZETA converters.	**10**
4	**Fundamental of Electric Drives**: Concept/Block diagram of electric drive, Types of loads and Speed-Torque Characteristics, Basic characteristics of DC motors, Two zone operation, Four quadrant operation (Operating modes), Principles of DC motor speed control Multi-quadrant operation of Drives**,** Selection of Power rating.	**04**
5	**DC Drives:** Analysis of separately excited dc motor with continuous and discontinuous mode of operations, closed loop control of dc motor drives, analysis of dc series motor drives, single-phase and three-phase controlled rectifier fed dc motors, Performance characteristics and analysis of chopper fed dc motors, motoring and braking operations, phase locked loop control of dc drives. DC servo Drives, Servo motors, position control.	**09**

List of Practicals / Tutorials:

1	To study V-I characteristics of SCR and measure latching and holding currents
2	To study triggering of (i) IGBT (ii) MOSFET (iii) power transistor
3	R and RC triggering scheme and to determine the firing angle control range
4	To study UJT trigger circuit for firing the SCRs of ac-dc converter
5	To study operation of single-phase half wave controlled rectifier with (1) R- load (2) RL load (3) RLE load
6	To study operation of single-phase semi controlled rectifier with (1) R- load (2) RL load (3) RLE load
7	To study operation of single-phase Full controlled rectifier with (1) R- load (2) RL load (3) RLE load
8	To study operation of Three-phase Half controlled rectifier with (1) R- load (2) RL load (3) RLE load
9	To study operation of Three-phase Full controlled rectifier with (1) R- load (2) RL load (3) RLE load
10	To study operation of Buck Converter in CCM & DCM Mode.
11	To study operation of Boost Converter in CCM & DCM Mode.
12	To study operation of Buck-Boost Converter in CCM & DCM Mode.

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13	To study operation of Rectifier controlled DC Drives

Reference Books:

1	Muhammad H. Rashid, Power Electronics: Circuits, Devices and Applications, Pearson Education, New Delhi
2	M. D. Singh and K. B. Khanchandani, Power Electronics, Tata McGraw-Hill Publishing Company Ltd., New Delhi
3	P. S. Bhimbra, Power Electronics, Khanna Publishers, New Delhi
4	Ned Mohan, Tore M. Undeland and William P. Robbins, Power Electronics: Converters, Applications and Design, John Wiley & Sons, Inc., New York
5	L Umanand, Power Electronics, Essentials & Applications, Wiley India
6	G. K. Dubey, Fundamental of Electrical Drives, Narosa Publication
7	R. Krishnanan, Electric Motor Drives: Modeling, Analysis and Control, Pearson Publications.
8	Vedam Subramanyam, "Power Electronics – Devices, Converters and Applications", New Age International Publishers Pvt. Ltd., Bangalore, 2nd ed. 2006.
9	P.S. Bimbhra, "Power Electronics", Khanna Publishers, New Delhi, 2012..

Supplementary learning Material:	
1	NPTEL Course : Fundamental of Power Electronics Link : https://onlinecourses.nptel.ac.in/noc22_ee03/preview
2	Coursera Course : Power Electronics Specialization Link : https://www.coursera.org/specializations/power-electronics
3	https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Seminar/Poster Presentation
- Industrial/ Field visits
- Course Projects

Internal Evaluation: The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

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Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
25%	25%	20%	10%	10%	10%	

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.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Analyze operation of devices and choose the same suitable for an application	**10**
CO-2	Analyze and compare the performance of various AC to DC Converter	**30**
CO-3	Analyze and compare the performance of Various DC to DC Converter	**30**
CO-4	Analyze different control circuits of dc motor drives	**25**
CO-5	Design a prototype model of Power electronics converter & DC Drives	**05**

Curriculum Revision:	
Version:	2.0
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	
Next Review on (Month-Year):	June-2025

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