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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 80034

M.E. / M.Tech. DEGREE END-SEMESTER EXAMINATIONS – JAN. / FEB. 2026

First Semester

Power Systems Engineering

P23PS103 – ANALYSIS OF POWER CONVERTERS

(Regulation 2023)

Time: Three Hours

Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Give the importance of free-wheeling diode in AC-DC converters.	2	K2	CO1
2.	Identify the impact of source impedance on converter performance.	2	K2	CO1
3.	Define the term displacement factor.	2	K1	CO2
4.	Give any two examples for resistive–inductive(RL) loads.	2	K1	CO2
5.	Mention any four advantages of IGBT switch over MOSFET.	2	K1	CO3
6.	Thyristors are not preferred for inverters. Why? Justify your answer.	2	K2	CO3
7.	What is the purpose of connecting a diode in anti-parallel with a thyristor in inverter circuits?	2	K2	CO4
8.	What is space vector modulation?	2	K1	CO4
9.	Mention any two disadvantages of PWM control.	2	K1	CO5
10.	List the advantages of three phase Impedance source inverters over single phase inverters.	2	K1	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	A single-phase full-wave ac voltage controller controls power flow from a 230 V, 60 Hz ac source into a resistive load. The maximum desired output power is 10 kW. Calculate i) The maximum rms current value of thyristors ii) the peak current of thyristors iii) the peak value of thyristor voltage.	13	K2	CO1
	(OR)			
b)	Explain the operation of a single-phase full converter with RL load with a neat diagram and waveforms.	13	K2	CO1
12. a)	i. Three-phase fully controlled converter is connected to a supply voltage of 230 volt per phase and frequency is 50 Hz. The source inductance is 4 mH. The load current on DC side is constant at 20 A. If the load consists of a SC source voltage of 400 V an internal resistance of 1ohm, compute the following: (i) Firing angle (ii) Overlap angle.	6	K4	CO2
	ii. Analyze how switching frequency and load type affect the ripple factor and voltage regulation in a three-phase AC–DC converter.	7		
	(OR)			
b)	Illustrate the operation of a three-phase full-wave bidirectional controller connected to a star connected resistive load. Draw necessary voltage and current waveforms with $\alpha = 60^\circ$.	13	K2	CO2
13. a)	Explain the effectiveness of various harmonic elimination techniques in improving power quality.	13	K2	CO3
	(OR)			
b)	Apply PWM control technique to a single-phase AC voltage controller and sketch the gating signals, output voltage, and load current waveforms for a resistive load.	13	K3	CO3
14. a)	Discuss the conduction pattern of thyristors in a three-phase inverter operating in 180° mode. Also explain how does the waveform shape vary with load type and switching sequence?	13	K2	CO4
	(OR)			
b)	i. Differentiate between current source inverter (CSI) and voltage source inverter (VSI) in terms of significant parameters.	7	K2	CO4

	ii.	A three-phase inverter is supplied from a 660 V DC source and feeds a star-connected resistive load of 20 Ω /phase. For 120° conduction mode, calculate: (a) RMS load current, (b) total load power, and (c) peak thyristor current rating.	6		
15.	a)	i. Explain the basic operating principle of any two types multilevel inverter topologies.	10	K2	CO5
		ii. Compare different multilevel inverters based on the requirement of number of power electronic devices.	3		
		(OR)			
	b)	Explain the working principle of a three level diode-clamped multilevel inverter with the help of circuit diagram and waveforms.	13	K2	CO5

PART – C

(1 x 15 = 15Marks)

Q.No.	Questions	Marks	KL	CO
16.	a) Analyze the working principle of a 12-pulse converter with the help of a schematic diagram and mathematically show that the lowest input current harmonic is 11 th order.	15	K3	CO5
	(OR)			
	b) Analyze the operation of a three-phase five level Cascaded Multilevel Inverter and sketch the output voltage waveform for one phase. Also explain how does increasing the number of levels affect output waveform quality and device stress?	15	K3	CO5