Reg.No.:												

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

Question Paper Code: 80033

M.E. / M.Tech. DEGREE END-SEMESTER EXAMINATIONS – FEB. 2025
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.	What is the function of freewheeling diode in controlled rectifier?	2	K2	CO1
2.	Write any two advantages of GTO over SCR.	2	K2	CO1
3.	What is the effect of source inductance in fully controlled bridge rectifier during continuous conduction mode?	2	K2	CO2
4.	Define peak inverse voltage.	2	K2	CO2
5.	How shoot through fault can be prevented in voltage source inverter?	2	K2	CO3
6.	List the disadvantages of line-commutated inverters.	2	K2	CO3
7.	Write any two differences between voltage and current source inverters.	2	K2	CO4
8.	What is the purpose of feedback diodes in inverters?	2	K2	CO4
9.	What is the role of dc-link capacitor in inverters?	2	K2	CO5
10.	List the advantages of a cascaded multilevel inverter.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.		Questions	Marks	KL	CO
11.	a)	Describe the working of 1 – φ fully controlled bridge converter in the rectifying and inversion modes. Also, derive the expression for average output voltage and RMS output voltage.	13	K3	CO1
		(OR)			
	b)	A single-phase fully controlled bridge is operated with a resistive load R=10 ohms, the input voltage to the bridge is 230 V. Calculate the average load voltage, RMS load voltage, form factor, ripple factor and average load current.	13	K3	CO1
12.	a)	Three phase fully controlled converter is connected to a supply with a voltage magnitude of 230 V (per phase) and frequency of 50 Hz. The source impedance is 4 mH. The load current in DC side is constant at 20 A. If the load consists of a DC source voltage of 400 V an internal resistance of 1 ohm, compute the following: i. firing angle and ii. overlap angle.	13	K3	CO2
		(OR)			
	b)	With circuit diagram and waveforms, explain the principle of operation of three phase fully controlled bridge converter feeding RL load. Also, derive the expression for average output voltage and current.	13	K3	CO2
13.	a)	Explain the voltage control of single phase inverters with necessary waveforms.	13	K2	CO3
		(OR)			
	b)	Explain how sinusoidal PWM technique is useful in eliminating the harmonics from single-phase inverters.	13	K2	CO3
14.	a)	Explain the working of a three phase inverter feeding three-phase delta connected resistive load with 120^0 mode of conduction.	13	K2	CO4
		(OR)			
	b)	Explain the space vector PWM technique as applicable to 3-phase inverter control with neat schematic diagrams.	13	K2	CO4
15.	a)	Draw the circuit diagram of cascaded and flying-capacitors multilevel inverters. Also, explain the need for multilevel inverters.	13	K2	CO5
		(OR)			
	b)	Explain briefly the following modulation techniques with relative advantages and disadvantages. i. Multiple PWM ii. Sinusoidal PWM iii. Delta modulation.	13	K2	CO5

PART – C

(1 x 15 = 15 Marks)

Q.No.			Questions	Marks	KL	CO
16.	a)	i.	Explain the operation of twelve pulse converter with relevant waveforms.	8	K2	CO3
		ii.	A three phase full converter is operated from a three – phase, 230V, 60Hz supply. The load is highly inductive and the average load current is Ia = 150 A with negligible ripple. If the delay angle is $\alpha = 60^0$. Determine the ratings of thyristors.	7	K3	CO5
			(OR)			
	b)		A three phase fully controlled bridge converter with 415 V supply, 0.04 ohms resistance per phase and 0.25 ohms reactance per phase is operating in the inverting mode at a firing angle of 35°. Calculate the mean generator voltage when the current level is at 80 A. The thyristors voltage drop is 1.5 V.	15	K3	CO4