

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: B.TECH.
BRANCH: EEE

SEMESTER : V
SESSION : MO/2023

SUBJECT: EE353 POWER ELECTRONICS

TIME: 3 Hours

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Before attempting the question paper, be sure that you have got the correct question paper.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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Q.1(a)	What are the major categories of power converters depending upon the type of power conversion? Explain briefly.	[5] 1	1
Q.1(b)	Define (i) Peak Repetitive Forward Blocking Voltage, (ii) Peak Surge (Non-Repetitive) Forward Blocking Voltage, (iii) Peak Working Reverse Voltage, (iv) dv/dt Rating and (v) di/dt rating for a thyristor.	[5] 1	1
Q.2(a)	Differentiate between natural commutation and class A commutation	[5] 2	2
Q.2(b)	Compute the value of R & C that will divide static and dynamic voltages equally between series-connected 18 SCRs. The maximum permissible blocking voltage of each Thyristor is 500V. These SCRs have a maximum difference of 1mA in their off-state leakage current and a maximum difference of 30 μ C in reverse-recovery charge. The series string is supplied from a voltage source of 7500Vdc	[5] 2	2
Q.3(a)	Draw and analyze the power circuit of a fully controlled single-phase bridge rectifier with a highly inductive load without a freewheeling diode. Also draw the waveform of load voltage, Thyristors current, and supply current. Assume firing angle (α) = $\pi/3$ radian.	[5] 3	3
Q.3(b)	Analyze the output load voltage waveform and derive the magnitude for output average voltage for a three-phase fully controlled rectifier for firing angle $\alpha = (2\pi/3)$ in the case of resistive load.	[5] 3	3
Q.4(a)	Give an example of a chopper where regenerative braking is possible and explain how with the waveform of load voltage and load current.	[5] 4	4
Q.4(b)	A step-up chopper has an input voltage of 220V and an output voltage of 660V. If the conducting time of the thyristor-chopper is 100 μ s, then compute the pulse width of output voltage.	[5] 4	4
Q.5(a)	Design a three-phase sinusoidal-PWM-based inverter. Show the pulse generation schematic and power circuit of the three-phase inverter.	[5] 5	5,6
Q.5(b)	Obtain load voltage waveform for 180 $^\circ$ mode of conduction in the case of a three-phase inverter with resistive load.	[5] 5	5,6

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