



Paper id: 250634

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BTECH
(SEM VI) THEORY EXAMINATION 2024-25
POWER ELECTRONICS

TIME: 3 HRS

M.MARKS: 70

Note: Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1. Attempt all questions in brief.

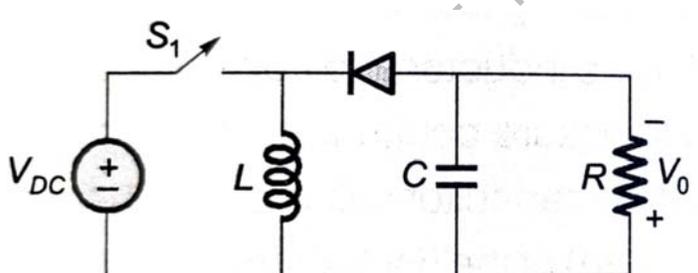
02 x 7 = 14

Q no.	Question	CO	Level
a.	Explain power Mosfet	1	K2
b.	Define the term latching current and holding current.	1	K1
c.	Explain the difference between freewheeling and feedback diodes.	3	K2
d.	Describe briefly the various control strategies used for varying duty cycle in choppers.	2	K2
e.	What is the difference between AC Voltage controller and Cycloconverter.	4	K2
f.	Which mode of operation is preferred in a three-phase Voltage Source Inverter (VSI): 120-degree conduction mode or 180-degree conduction mode? Justify your answer with appropriate reasons.	5	K3
g.	Briefly explain the methods of voltage control in a single-phase inverter.	5	K2

SECTION B

2. Attempt any three of the following:

07 x 3 = 21

a.	Draw and explain the V-I characteristics of a thyristor with a suitable diagram. Briefly mention the different methods of triggering a thyristor.	1	K2
b.	The input voltage V_{DC} of the buck boost converter shown below varies from 32V to 72V. Assume that all components are ideal, inductor current is continuous and output voltage is ripple free. Find the range of duty ration D of the converter for which the magnitude of the steady state output voltage remains constant at 48V. 	2	K4
c.	Explain the operation of Current Source Inverter (CSI) in detail with circuit diagram and waveforms.	5	K2
d.	Explain the principle of Integral Cycle Control in AC Voltage Controller with suitable diagram and mention its output voltage formula. A single-phase voltage controller has input voltage of 230V, 50Hz and the load of $R=15 \text{ ohm}$. For 6 cycles ON and 4 Cycle OFF determine (i) rms output voltage (ii) input	4	K3



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	power factor (pf).		
e.	Compare the operation of single-phase half-wave and single-phase full-wave rectifiers. Draw the circuit diagrams and corresponding output voltage waveforms for the following types of loads: (i) Resistive (R) Load, (ii) Resistive-Inductive (RL) Load, and (iii) Resistive-Inductive with Back EMF (RLE) Load. Also, derive the expression for average output voltage.	3	K3

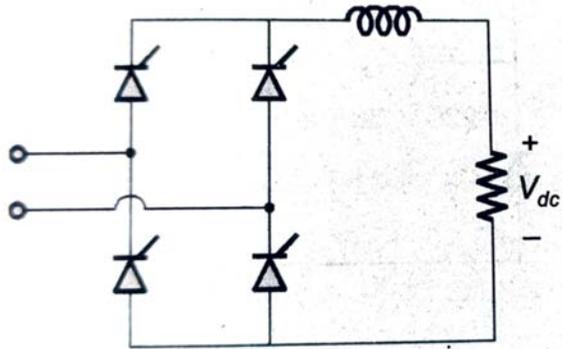
SECTION C

3. Attempt any one part of the following: 07 x 1 = 07

a.	Describe the protection for gate and thyristor in detail with suitable diagram. Explain the need and the problem faced in connecting thyristors in series and parallel.	1	K2
b.	Explain commutation and its types with suitable examples. Also, describe any one class of commutation in detail with a diagram.	1	K2

4. Attempt any one part of the following: 07 x 1 = 07

a.	With the help of circuit diagrams, explain the types of single-phase semi converters. Draw the output voltage waveforms for RL load. A single-phase Semi Converter connected to 230V, 50Hz source is feeding load $R=10\ \Omega$ in series with a large inductance that makes the load current ripple free. For firing angle of 45 degree. Calculate the (i) average output voltage (V_o) (ii) power factor (pf).	3	K3
b.	Describe the operation of full wave rectifier with output voltage waveforms and derive the expression for output voltage. The fully controlled thyristor converter in the figure is fed from a single-phase source. When firing angle is 0 degree, the dc output voltage of the converter is 300V. What will be the output voltage for a firing angle of 60 degree, assuming continuous conduction.	3	K4



5. Attempt any one part of the following: 07 x 1 = 07

a.	What is chopper? Explain the operation of step-up chopper in detail with circuit diagram, output voltage and output current waveforms. Derive an expression for average output voltage in terms of input voltage and duty	2	K3
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	cycle. A step-up chopper is used to feed a load at 400V dc from 250V dc source. The inductor current is continuous. If the 'OFF' time of the switch is 20µs. Find the switching frequency of the chopper.		
b.	Describe the operating principle of buck converter with circuit diagram, output voltage waveform and its expression. Explain four quadrant chopper (TYPE E) chopper with detailed circuit diagram.	2	K2

6. Attempt any one part of the following: 07 x 1 = 07

a.	Describe types of AC Voltage controller with diagram. Explain the phase control scheme principle of AC Voltage Controller with circuit diagram and waveforms in detail for RL Load for (i) Single phase half wave AC Voltage Controller (ii) Single phase full wave AC Voltage Controller. Mention the output rms voltage expression, phase control expression and range of alpha for controlled output voltage.	4	K3
b.	Explain the principle of working of types of single phase to single phase cycloconverter with circuit diagrams and output waveforms.	4	K2

7. Attempt any one part of the following: 07 x 1 = 07

a.	What are PWM techniques? Explain different types of PWM along with their advantages. Explain sinusoidal PWM with suitable diagram in detail. Define modulation index (MI) and discuss its effect when MI is less than and greater than 1. (i)- In a single PWM inverters, find the pulse width if fifth order harmonic is eliminated? (ii)- In single PWM if pulse width is equal to 120 degrees for input voltage of 220 V dc Find the rms value of output voltage is?	5	K5
b.	Draw circuit diagram of three phase inverter. With the line and phase voltage expression explain three phases 180-degree six step conduction mode VSI. Describe switching pattern of thyristors with circuit diagram of conduction of switches, voltage generated in each phase. Also, Draw phase voltage and line voltage waveforms.	5	K3