PAPER ID-420866

Subject Code: KEE603

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM VI) THEORY EXAMINATION 2021-22
POWER ELECTRONICS

Time: 3 Hours ***Total Marks: 100***

Note: Attempt all Sections. If you require any missing data, then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2*10 = 20

Qno	Questions	CO
(a)	What are di/dt and dv/dt ratings of SCRs? What happens if these ratings are exceeded?	1
(b)	Give the merits and demerits of a GTO as compared to a conventional SCR.	1
(c)	Explain the following current ratings of SCR (i) Average ON state current (ii) RMS ON state current	2
(d)	What are the different methods for turning off (Commutation) of an SCR? Draw the power circuit diagram of ClassC and D Commutation methods.	2
(e)	Explain the effect of freewheeling diode in power converters. Also, justify the statement "Freewheeling diode improves the power factor of the system".	3
(f)	Write the comparison between non-circulating current mode and circulating current mode of operation of Dual-Converters.	3
(g)	List the advantages and disadvantages of single-phase half-wave a.c. voltage controllers.	4
(h)	Distinguish between two-stage and multi-stage sequence control of a.c. voltagecontrollers. What are the advantages of multistage sequence control over two-stage sequencecontrol?	4
(i)	Explain Pulse Width Modulation (PWM)techniqueand advantages of SinusoidalPulse Width Modulation (SPWM) technique.	5
(j)	Compare the constructional and operational differences between voltage source and current-source inverters.	5

SECTION B

2. Attempt any *three* of the following: 10*3 = 30

Qno	Questions	CO
(a)	Draw the turn-off characteristic of an SCR and explain the mechanism of turn-off in detail.	1
(b)	A thyristor string is formed by the series and parallel connectionof thyristors. The voltage and current ratings of the string are 6 kV, and 4 kA respectively.Available thyristors have the voltage and current ratings of 1.2 kV and 1 kA, respectively.The string efficiency is 90% for both the series and parallel connections. Calculate thenumber of thyristors to be connected in series and parallel.	2
(c)	A single-phase fully-controlled bridge circuit shown in Fig. 1is used for obtaining a regulated d.c. output voltage. The RMS value of the a.c. inputvoltage is 230 V, and the firing angle is maintained at $\pi/3$,so that the load-currentis 4 A.	3

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	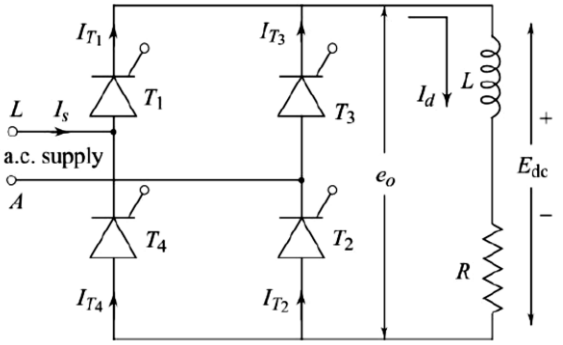 Fig. 1. (i) Calculate the d.c. output voltage and the active and reactive power input. (ii) Calculate the d.c. output voltage and the active and reactive power inputif a freewheeling diode is used at the output. Assuming that the load resistance remains the same and the firing angle is maintained at $\pi/3$.	
(d)	Explain the working of single phase to single-phase step up cycloconverters with power circuit diagram and waveforms.	4
(e)	With the help of neat circuit diagram and associated waveforms, explain theoperation of single-phase full-bridge MOSFET based voltage source inverter with (i) Resistive load (ii) Inductive load.	5

SECTION C

3. Attempt any *one* part of the following: 10*1 = 10

Qno	Questions	CO
(a)	Explain in detail the switching performance of BJT with relevant waveforms.	1
(b)	Latching current for an SCR inserted in between a DC voltage source of 200V and the load is 100 mA. Compute the minimum width of Gate Pulse current required to turn on this SCR in the case of load R = 20 Ω in series with L = 0.2 H.	1

4. Attempt any *one* part of the following: 10 *1 = 10

Qno	Questions	CO
(a)	With the help of a neat circuit diagram and associated waveforms, discuss theoperation of Buck converter.List the advantages of Buck-Boost converter over Buck and Boost converters.	2
(b)	Consider the buck-boost converter of Fig. 2. The input voltageto this converter is E_{dc} = 14 V. The duty cycles α = 0.6 and the switching frequency is 25kHz. The inductance L = 180 mH and filter capacitance C = 220 mF. The average loadcurrent I_0 = 1.5 A.	2

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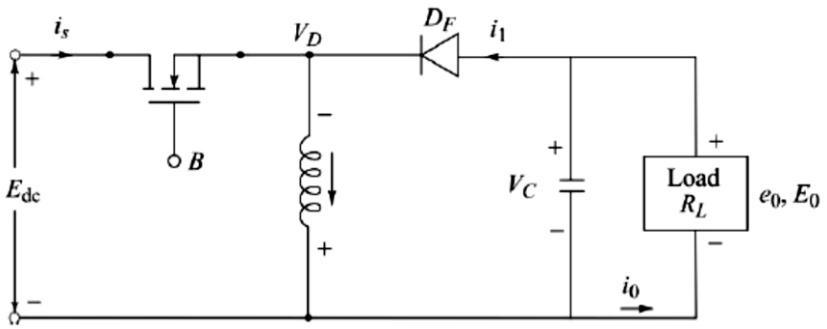


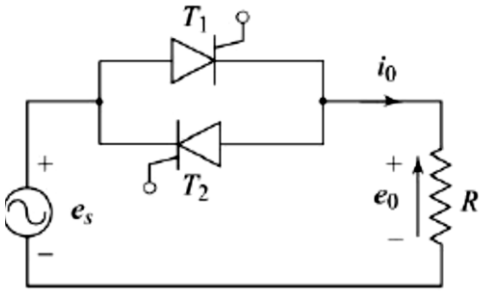
Fig. 2.

Compute:
(a) the average output voltage, E_0;
(b) the peak-to-peak output voltage ripple, ΔV_c;
(c) the peak-to-peak current of inductor, ΔI; and
(d) the peak current of the device I_p.

5. Attempt any *one* part of the following: 10*1 = 10

Qno	Questions	CO
(a)	Explain the operation of a three-phase, fully-controlled bridge converterwith inductive load with the help of suitable voltage and current waveforms at α =30° and derive the expression for average load voltage.	3
(b)	Describe the working of single-phase fully-controlled bridge converter with Resistive-Inductive (RL) load (i) Supply voltage and current, (ii) Load voltage and current.	3

6. Attempt any *one* part of the following: 10*1 = 10

Qno	Questions	CO
(a)	A single-phase a.c.voltage controller of Fig. 3 feeds power to a resistiveload of 4 Ω from 230 V, 50 Hz source.  Fig. 3. Determine and draw the suitable wave diagram of following: (i) the RMS output voltage and current for any firing angle α (ii) the peak values of average and RMS thyristor currents for any firing angle α. (iii) the minimum circuit turn-off time for any firing angle α.	4
(b)	Describe the basic principle of working of a single-phase-to-single-phasestep down cycloconverter for abridge-type cycloconverter.	4

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7. Attempt any *one* part of the following: 10*1 = 10

Qno	Questions	CO
(a)	With the help of neat circuit diagram and waveforms, explain briefly the operationof three-phase bridge inverter with resistive inductive (RL) load in 180° conduction mode.	5
(b)	A single-phase half bridge inverter has R Load R= 2 ohm, and DC source voltage Vs/2=115V. Sketch the waveforms of following (i) Output voltage (ii) Output Current (iii) Thyristor current and diode current (iv) Power delivered to the load due to fundamental current	5