

**B.Tech. – VIEP – ELECTRICAL ENGINEERING
(BTELVI)**

Term-End Examination

December, 2017

00279

BIEEE-018 : ADVANCED POWER ELECTRONICS

Time : 3 hours

Maximum Marks : 70

Note : Attempt any **five** questions. Missing data, if any, may be suitably assumed. All questions carry equal marks.

1. (a) What is an SCR ? Sketch static I-V characteristics of an SCR and describe its different modes of operation. 7
- (b) Explain the working of RC triggering circuit for an SCR. Include relevant waveforms. 7
2. (a) Give the merits and demerits of GTOs as compared to conventional thyristors. Describe switching performance in a GTO with relevant voltage and current waveform. 7
- (b) For the circuit shown in Figure 1,
 - (i) calculate the maximum values of di/dt and dv/dt for the SCR.

- (ii) find the rms and average current ratings of the SCR for firing angle delays of 90° and 150° .

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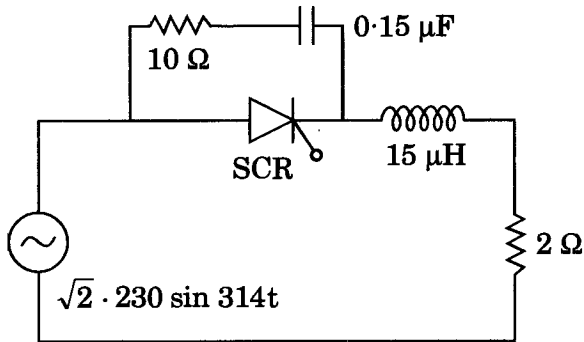


Figure 1

3. Describe the working of a single-phase full converter in the inverter mode with RLE load. Illustrate your answer with waveforms for source voltage, E , load voltage and current, source current, current through and voltage across one SCR. Assume continuous conduction. Also find the circuit turn-off time.

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4. (a) Describe how a freewheeling diode improves power factor in a converter system.
- (b) A single-phase transformer, with secondary voltage of 230 V, 50 Hz, delivers power to load $R = 10 \Omega$ through a half wave controlled rectifier circuit. For a firing angle delay of 60° , determine the rectification efficiency, form factor and voltage ripple factor.

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5. (a) Enumerate the difference between Voltage source inverter and Current source inverter. A single-phase capacitor commutated current source inverter feeds a load R (resistive). Describe its working with appropriate circuit and waveforms. Also find the circuit turn-off time for the thyristors. 10
- (b) Calculate the output frequency of a series inverter with the following parameters :
Inductance $L = 6 \text{ mH}$, Capacitance $= 1.2 \text{ } \mu\text{F}$,
Load resistance $R = 100 \text{ } \Omega$, $T_{\text{off}} = 0.2 \text{ ms}$. 4
6. (a) Explain, what are Pulse-Width Modulated (PWM) inverters. List different PWM techniques and explain the sinusoidal pulse modulated PWM inverter. 7
- (b) Explain how unwanted harmonics in the inverter output can be eliminated using transformer connections. 7
7. What is SVC ? Describe how SVC regulates the reactive power flow and improves the system power factor. Also draw the relevant phasor diagrams. Derive an expression for the resultant current drawn by an SVC and comment on the flow of reactive power. 14

8. (a) Explain the necessity of Series and Parallel connection of SCRs. Discuss the problem arising in series and parallel connections. 7
- (b) For a 3-phase full converter, explain how output voltage wave, for a firing angle of 30° is obtained by using phase voltages. 7
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