Code: AE26

Subject: POWER ELECTRON

ROLL NO.

AMIETE - ET (OLD SCHEME)

Time: 3 Hours

JUNE 2012

StudentBounty.com PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the O.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.
- Out of the remaining EIGHT Ouestions answer any FIVE Ouestions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or the best alternative in the following:

 (2×10)

- a. An IGBT has three terminals called
 - (A) Collector, emitter and gate
 - (B) Collector, emitter and base
 - (C) Drain, source and gate
 - (D) Drain, source and base.
- b. When a thyristor gets turned on, the gate drive
 - (A) Should not be removed as it will turn-off the SCR
 - (B) May or may not be removed
 - (C) Should be removed
 - (D) Should be removed in order to avoid increased losses and higher junction Temperature
- c. The effect of source inductance on the performance of single-phase and threephase full converters is to
 - (A) Reduce the ripples in the load current.
 - (B) Make discontinuous current as continuous
 - (C) Reduce the output voltage
 - (D) Increase the load voltage
- d. In dc choppers, if T is the chopping period, then output voltage can be controlled by PWM by varying
 - (A) T keeping T_{on} constant **(B)** T_{on} keeping T constant
 - (C) T_{off} keeping T constant
- **(D)** Both **(B)** and **(C)**

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- StudentBounty.com A single-phase CSI has capacitor C as the load. For a constant source curre the voltage across the capacitor is
 - (A) Square wave (C) Step function

(**B**) Triangular wave

- (**D**) Pulsed wave
- f. A load resistance of 10Ω is fed through a 1 -phase voltage controller from a voltage source of 200 sin314t. For a firing angle delay of 90°, the power to load delivered in kW is

(A) 0.5	(B) 0.75
(C) 1.0	(D) 2.0

- g. A cycloconverter is a
 - (A) Frequency changer (f_c) from higher to lower frequency with one state conversion
 - (B) f_c from higher to lower frequency with two state conversion
 - (C) f_c from lower to higher frequency with one state conversion
 - (D) Either (A) or (C)
- h. A four quadrant operation requires
 - (A) Two full converters in series
 - **(B)** Two full converters connected back to back
 - (C) Two full converters connected in parallel
 - (D) Two semi-converters connected back to back
- In a 3-phase semi-converter, the three SCRs are triggered at an interval of i.

(A)	60°	(B) 90°
(C)	120°	(D) 180°

- In dc choppers, the waveforms for input and output voltages are respectively j.
 - (A) Discontinuous, continuous **(B)** Both continuous.
 - (C) Both discontinuous (**D**) Continuous, discontinuous

Answer any FIVE Questions out of EIGHT Questions. Each question carries 16 marks.

- Q.2 a. Snubber circuit for an SCR should primarily consist of capacitor only. But, in actual practice, a resistor is used in series with the capacitor. Discuss. (8)
 - b. Explain resistance and resistance-capacitance firing circuits. How is it different from UJT firing circuit? (8)
- Q.3 a. Explain dual converter both in circulating and non circulating modes with circuit diagram and waveforms (8)
 - b. A single phase voltage controller feeds power to a resistive load \mathbf{O} 3 from 230 V, 50 Hz source. Calculate:

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StudentBounty.com (i) The maximum values of average and rms thyristor currents for any firing angle α , (ii) The minimum circuit turnoff time for any firing angle α .

- a. Discuss the principle of step down chopper. Explain its working with RL 0.4 load.
 - b. Explain the working of impulse commutated chopper with appropriate circuit diagram and waveforms. (8)
- 0.5 a. Distinguish clearly between voltage commutation and current commutation in thyristor circuits. Also discuss how the voltage across the commutating capacitor is reversed in a commutating circuit. (8)
 - b. What are the advantages of voltage source inverter fed drives? (8)
- **Q.6** a. Draw the waveforms of source voltage, gating signals, output voltage, source and output currents and voltage across one SCR for a single phase voltage controller feeding a resistive load. Explain the working with the help of these waveforms. (8)
 - b. Draw and explain the three phases half wave converter (3-pulse) circuit with input and output voltage waveforms for firing angle 30 degree and R,L load. Also derive output voltage expression. (8)
- 0.7 a. A 3-phase VSI feeds three-phase star connected resistive load. Obtain the output phase and line voltage if three SCRs conduct at a time. (180 degree mode) (8)
 - b. What is pulse width modulation in concern with inverter? List the various PWM techniques. How do these differ from each other? (8)
- a. What is the principle of operation of cycloconverters? Explain the effect **Q.8** of load inductance on the performance of cycloconverters. (8)
 - b. A 3-phase to single-phase cycloconverter employs 3-pulse positive and negative group converters. Each converter is supplied from delta/star transformer with per phase turns ratio of 2:1. The supply voltage is 400 V, 50 Hz. The RL load has R=2 Ω and at low output frequency, $\omega L = 1.5 \Omega$. In order to account for commutation overlap and thyristor turn-off time, the firing angle in the inversion mode should not exceed 160°. Compute (i) The value of the fundamental rms output voltage, (ii) Rms output current and
 - (iii) Output power.

(8)

- Q.9 Write short note on: (any **TWO**)
 - (i) Chopper Circuit design.
 - (ii) Voltage control of three-phase Inverter
 - (iii) Industrial applications of DC and AC Drive. (8×2)

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