POWER ELECTRONICS (SEMESTER - 6)

CS/B.TECH(EIE-O)/SEM-6/EE-604/09

1. .....
Signature of Invigilator

2. .....
Signature of the Officer-in-Charge

Reg. No. | | | | | | | | | | | | | | |

Roll No. of the Candidate | | | | | | | | | | | | | | |

CS/B.TECH(EIE-O)/SEM-6/EE-604/09

ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009

POWER ELECTRONICS (SEMESTER - 6)

Time : 3 Hours] [Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
2. a) In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.
   b) For **Groups – B** & **C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.
3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
4. Read the instructions given inside carefully before answering.
5. You should not forget to write the corresponding question numbers while answering.
6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
9. Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

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Marks Obtained

	Group – A										Group – B			Group – C				
Question Number																	***Total Marks***	***Examiner's Signature***
Marks Obtained																		

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Head-Examiner/Co-Ordinator/Scrutineer

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GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) A naturally commutated converter supplying very high inductive load can act as a rectifier when the firing angle is

a) $> 90^\circ$ b) $< 90^\circ$

c) $= 90^\circ$ d) 120°. ☐

ii) The peak inverse voltage developed across an SCR in a bridge rectifier connected to V_m sin wt is

a) V_m b) $2V_m$

c) $\frac{V_m}{2}$ d) $\frac{V_m}{V_2}$. ☐

iii) An SCR remains in forward blocking state till the anode current

a) > latching current b) < latching current

c) > holding current d) < holding current. ☐

iv) An SCR can be used as

a) amplifier b) switch

c) both switch & amplifier d) capacitor. ☐

v) In a single phase full converter, the output voltage pulsates at a frequency equal to

a) f b) $2f$

c) $3f$ d) $6f$. ☐

vi) Dual converter provides operation in

a) 1st quadrant

b) 2nd quadrant

c) 1st & 2nd quadrants

d) all four quadrants of $V_{out} - I_{out}$ plane. ☐

vii) The transition of SCR from forward blocking state to forward conduction state is due to

a) positive feedback action

b) negative feedback action

c) no feedback action

d) two-transistor action. ☐

viii) In a voltage source inverter, the shape of the load current depends on

a) load parameter b) input voltage

c) input frequency d) input power factor. ☐

ix) The SCR is connected in series to increase

a) voltage capability of the string

b) current capability of the string

c) both current & voltage capabilities of the strring

d) none of these. ☐

x) If f_s & f_o are the frequencies of the source voltage & output voltage of a step-down cyclo converter respectively, then the correct relation between f_s & f_o is

a) $f_o = f_s$ b) $f_o = 2f_s$

c) $f_o < f_s$ d) $f_o > 1{\cdot}2\ f_s$. ☐

xi) Which of the following devices do not exhibit second breakdown phenomenon ?

a) GTO b) SCR

c) BJT d) (a) & (b) both. ☐

xii) Which one is the most preferred method of triggering ?

a) Gate b) dv/dt

c) Light d) Voltage. ☐

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Explain with relevant waveforms, the principle of resonant commutation.

3. Discuss the effect of free wheeling diode put across inductive load supplied by a single phase bridge converter. Show the waveform of load voltage with & without free wheeling diode. 3 + 2

4. Explain how a DC to DC converter is used to get variable DC output voltage from a fixed DC input. Can output voltage be more than input voltage ? 4 + 1

5. What do you mean by blocked group operation & circulating current mode operation of a cyclo converter ? Explain.

6. A Single phase converter connected to 200 V, 50 Hz supply. Find average & r.m.s. values of the output voltage if firing angle is 45°. Deduce the expression used. Assume continuous conduction.

GROUP – C

(Long Answer Type Questions)

Answer any *three* questions. 3 × 15 = 45

7. a) Explain with relevant input-output waveforms, the principle of operation of a 3-phase, 6-pulse full converter supplying a very high inductive load.

   b) A 3-phase, 6-pulse, full converter is connected to a 3-phase, 50 Hz, 220 V, star connected supply. The load current is constant with load resistance of 10 Ω.

   Firing angle $\alpha = 30^\circ$.

   Find the following :

   i) Average output voltage

   ii) Average output current

   iii) r.m.s. value of output current

   iv) Average output power

   v) Average & r.m.s. SCR current

   vi) Peak voltage rating of SCR. 8 + 7

8. a) Draw & explain the schematic circuit & waveforms of phase & line voltages of a three phase inverter for 180° conduction. Mention triggering sequence & period of conduction of each SCR. The load is resistive & star connected.

   b) What are the advantages & disadvantages of current source inverter over a voltage source inverter ? 12 + 3

9. a) What is a cyclo converter ? What benefits does it offer compared to inverter ?

   b) With the help of schematic diagram & relevant waveforms, explain the operation of a single phase cyclo converter.

   c) Discuss the applications of a cyclo converter. 4 + 7 + 4

10. a) What is meant by PWM technique of voltage control of Inverter.

    b) Discuss the principle of sinusoidal pulse modulation technique.

    c) What is the effect of source inductance on the performance of converter ?

    3 + 7 + 5

11. Write short notes on any *three* of the following : 3 × 5

    a) HVDC transmission

    b) Triac

    c) Dual converter

    d) UJT triggering circuit for SCR

    e) Resonant converter.

END