Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH (ECE)/SEM-6/EC-603/2012

2012

POWER ELECTRONICS

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

GROUP – A
(Multiple Choice Type Questions)

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

i) In a thyristor, anode current is made up of

a) electrons only b) holes only

c) electrons and holes d) none of these.

ii) Chopper control of DC motor provides variations in

a) frequency b) current

c) input voltage d) all of these.

iii) In a three phase full converter, the six SCRs are triggered at an interval of

a) 30 degree b) 60 degree

c) 90 degree d) 120 degree.

iv) For continuous conduction, each thyristor pair of a two pulse full converter should conduct for

a) α b) $\pi - \alpha$

c) $\pi + \alpha$ d) π.

v) In a pulse width modulation chop is per

a) T is kept constant, T_{on} is varied

b) T_{on} is kept constant, T is varied

c) both T & T_{on} are varied

d) Either T or T_{on} is varied.

vi) A 1 phase Cycloconverter changes 50Hz to 100Hz. Then one half wave of input will give rise to

a) one half wave of output voltage

b) one full wave of output

c) two full wave of output

d) either (b) or (c).

vii) In a buck regulator, as duty cycle increases output voltage

a) increases

b) decreases

c) it increases at no load & decreases at full load

d) decreases at no load increases at full load.

viii) A dc chopper is feeding RLE load, the current can be discontinuous

a) R/L is high b) α is low

c) E is high d) any of these.

ix) Forced commutation is generally used in

a) Controlled rectifier b) Chopper

c) UPS d) none of these.

x) Resonant converters controls the output power by

a) varying the switching frequency around resonating frequency

b) varying the on time of the switch

c) controlling the power loss in the switch

d) none of these.

xi) Input voltage surge does not effect the critical load in

a) On Line UPS b) Off line UPS

c) Normal UPS d) None of these.

xii) The reverse recovery time of semiconductor diodes will cause a reduction in output voltage of a bridge rectifier due to

a) Commutation failure

b) Overlap conduction

c) Premature commutation

d) Instantaneous commutation.

xiii) The softness factor for soft recovery & fast recovery diodes are respectively

a) 1, > 1 b) < 1, 1

c) 1, 1 d) 1, < 1

xiv) A single phase half wave circuit is one which produces number of pulses of load current during one cycle of source voltage

a) Two b) Three

c) Six d) One.

xv) The PIV in ac to dc converter system is highest in

a) 1φ full wave mid-point converter

b) 1φ full converter

c) 3φ bridge converter

d) 3φ half wave converter.

GROUP – B

(Short Answer Type Questions)

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

2. Draw and explain dynamic switching characteristics of Power BJT. 5

3. What do you mean by FBSOA and RBSOA. Explain the construction of IGBT. 2 + 3

4. A thyristor is used to feed a load resistance 8 ohms from a 230 V single phase supply. The ratings of thyristers are : repetitive peak current = 200A, (di/dt)max = 40A/us and (dv/dt) max = 150V/us. Design a snubber circuit for protection of thyrister. 5

5. Explain the two transistor analogy of thyristor. Derive an equation for anode current. State the condition for turn on. 2 + 2 + 1

6. What are the advantages of resonant converters over conventional DC to DC converters. State the concept of quasi resonant converter. 3 + 2

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Why is a three phase bridge full wave controlled rectifier called a six-pulse converter ? Explain with circuit diagram and output waveforms.

   b) A 3-phase full converter feeds power to a resistive load of 10 Ω. For a firing angle delay of 30°, the load takes 5 kW. Find the magnitude of per phase input supply voltage. 8 + 7

8. a) Explain the working principle of Buck Regulator with necessary circuit diagram and waveforms.

b) A buck regulator has an input of 18V. The required average output is 6V and the peak to peak output ripple voltage is 30m V. The chopping frequency is 20kHz. Assuming the peak to peak ripple current of induction is 1.0 A, calculate the duty ratio, the filter inductance and the filter capacitance. 7 + 8

9. a) How is the working of a full bridge single phase inverter different from that of half bridge circuit. Explain with the help of diagrams.

b) A single phase half bridge inverter has a resistive load of 10 ohm and centre tap dc input voltage of 96 volts. Compute

A) RMS value of output voltage

B) fundamental component of output voltage waveform.

C) first five harmonics of the output voltage

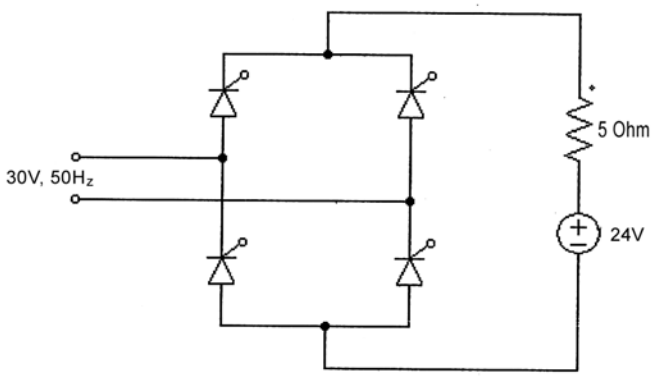
D) fundamental power consumed.

c) State the advantages of PWM technique over frequency modulation technique as used for SMPS.

d) What is zero voltage switching ? 4 + 4 + 3 + 1 + 3

10. A battery is charged by a fully controlled single phase converter as shown in fig. The input supply is 30V at 50Hz. The load consists of a 24V battery and a resistance of 5Ω

connected in series to limit the current. What is the minimum possible firing angle ? Compute the value of average output voltage. 1 + 6 + 4 + 4



11. Write short notes on any three of the following : $3 \times 5 = 15$

a) IGBT

b) UPS

c) Induction Heating

d) MOSFET

e) Various triggering methods of SCR.