C. U. SHAH UNIVERSITY
Winter Examination-2022

Subject Name : Power Electronics - I

Subject Code : 4TE05PEL1   **Branch: B.Tech (Electrical)**

Semester: 5   **Date: 22/11/2022**   **Time: 02:30 To 05:30**   **Marks: 70**

Instructions:
 (1) Use of Programmable calculator & any other electronic instrument is prohibited.
 (2) Instructions written on main answer book are strictly to be obeyed.
 (3) Draw neat diagrams and figures (if necessary) at right places.
 (4) Assume suitable data if needed.

Q-1   **Attempt the following questions:**   **(14)**

a) In the method of phase control, the phase relationship between ___ & ___ is controlled by varying the firing angle
a) supply current, supply voltage
b) end of the load current, end of the load voltage
c) start of the load current, start of the load voltage
d) load current, load voltage

1

b) In a single-phase half-wave thyristor circuit with R load & $Vs=Vm \sin\omega t$, the maximum value of the load current can be given by
a) 2Vm/R
b) Vs/R
c) Vm/2
d) Vs/2

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c) In a single pulse semi-converter using two SCRs, the triggering circuit must produce
a) two firing pulses in each half cycle
b) one firing pulse in each half cycle
c) three firing pulses in each cycle
d) one firing pulse in each cycle

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d) In a 3-phase full converter using six SCRs, gating circuit must provide
a) one firing pulse every 30°
b) one firing pulse every 90°
c) one firing pulse every 60°
d) three firing pulses per cycle

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e) For an RC full wave firing circuit the empirical formula for calculating the value of RC is
a) RC = 157/ω
b) RC = 157 x ω
c) RC = ω/157
d) RC = 157 x ω²

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f) The UJT terminals are   1

    a) E, B1 and B2
    b) E1, E2 and B
    c) E, G and C
    d) G, S and D

g) The effect of over-voltages on SCR are minimized by using   1
    a) RL circuits
    b) Circuit breakers
    c) Varistors
    d) di/dt inductor

h) False triggering of the SCRs by varying flux & noise is avoided by using   1
    a) F.A.C.L.F & C.B
    b) Shielded cables & twisted gate leads
    c) Snubber circuits
    d) di/dt inductor in series with the gate terminal

i) Thyristors are used in electronic crowbar protection circuits because it   1
possesses
    a) high surge current capabilities
    b) high amp ^{2}-sec rating
    c) less switching losses
    d) voltage clamping properties

j) The load commutated chopper circuit consists of   1
    a) two thyristors and one commutating capacitor
    b) four thyristors and one commutating capacitor
    c) two thyristors and two commutating capacitors
    d) four thyristors and two commutating capacitors

k) The control strategy in which on and off time is guided by the pervious   1
set of values of a certain parameter is called as
    a) time ratio control
    b) pulse width modulation
    c) current limit control
    d) constant frequency scheme

l) The value of anode current required to maintain the conduction of an   1
SCR even though the gate signal is removed is called as the
    a) holding current
    b) latching current
    c) switching current
    d) peak anode current

m) _____ are semiconductor thyristor devices which can be turned-on by   1
light of appropriate wavelengths.
    a) LGTOs
    b) LASERs
    c) MASERs
    d) LASCRs

n) GTOs have _____ as compared to the Conventional Thyristors.   1
    a) less on-state voltage drop
    b) less gate drive losses
    c) higher reverse blocking capabilities
    d) faster switching speed

Attempt any four questions from Q-2 to Q-8

Q-2		**Attempt all questions**	**(14)**
	A	Draw the structure of Power Diode. Explain the VI characteristics and switching characteristics of Power Diode with necessary diagrams.	**07**
	B	Write a technical short note on: IGBT	**07**
Q-3		**Attempt all questions**	**(14)**
	A	Discuss causes and effect of di/dt and dv/dt problem for Thyristor and Explain its remedies.	**07**
	B	Write a technical short note on: Power MOSFET	**07**
Q-4		**Attempt all questions**	**(14)**
	A	Define Rectification. For a single-phase full wave-controlled converter with R load, draw the circuit diagram and necessary waveforms. Derive the mathematical expressions of output voltage.	**07**
	B	Explain the two-transistor model of SCR using necessary diagram.	**07**
Q-5		**Attempt all questions**	**(14)**
	A	Define Turn ON time. List the method of Triggering. Explain the R-C triggering along with necessary circuit and waveforms.	**07**
	B	Explain 3-phase full wave AC voltage controller with Y and Δ connected load with necessary circuit diagrams and waveform.	**07**
Q-6		**Attempt all questions**	**(14)**
	A	Draw the circuit configuration of step-up chopper and explain its working. Derive its output voltage equation in terms of duty cycle and input voltage.	**07**
	B	Write a technical short note on: Thermal Protection of SCR using Heat Sink.	**07**
Q-7		**Attempt all questions**	**(14)**
	A	Define and classify A.C. voltage controllers. Explain in detail single phase A.C. Regulators.	**07**
	B	What do you mean by Cycloconverters? Explain working 1-Phase Cycloconverters with necessary circuit diagram and waveform.	**07**
Q-8		**Attempt all questions**	**(14)**
	A	Define Duty Cycle. Explain the variation in duty cycle in Pulse Width Modulation with necessary diagram.	**07**
	B	Define Series Resonance. Explain single-phase series resonant inverter using necessary circuit diagram and waveform.	**07**