Enrollment No: _____ Exam Seat No:_____

C. U. SHAH UNIVERSITY

Summer Examination-2022

Subject Name: Power Electronics - I

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

Semester: 5 **Date: 22/04/2022** **Time: 11:00 To 02:00** **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)**

(Fill in the blank with appropriate options given below)

a) A Triac and SCR are compared as _____.

(A) both are unidirectional devices, (B) Triac require more current for turn-on than SCR at a particular voltage, (C) Triac has less time for turn-off than SCR, (D) both are available with comparable V & I ratings)

b) _____ Semiconductor power device is not a current triggered device.
(A) Thyristor (B) GTO (C) Triac (D) MOSFET

c) Triac can be used only in _____.

(A) inverter (B) rectifier (C) multi-quadrant chopper (D) cyclo-converter

d) Power MOSFET is a _____ controlled device.

(A) voltage (B) current (C) frequency (D) none of the above

e) A BJT operates as a switch _____.

(A) under small signal conditions, (B) with no signal condition, (C) in the active region of transfer characteristics, (D) under large signal conditions

f) The temperature coefficient of resistivity for power BJT is _____.
(A) positive (B) negative (C) zero (D) positive & infinite

g) The on-state voltage drop across the IGBT is _____.

(A) less than that across the MOSFET
(B) greater than that across the MOSFET
(C) equal to that of MOSFET
(D) not compared with MOSFET

h) The maximum operating frequency of an IGBT is approximately___ kHz.

(A) 10 (B) 50 (c) 100 (D) 200

i) In a three-phase full converter, if load current is I and ripple free, then the average thyristor current is _____.

(A) I/2 (B) I/3 (C) I/4 (D) I/5

j) In a three-phase full converter, the output voltage is at a frequency equal to _____.

(A) supply frequency f (B) 2f (C) 3f (D) 6f

k) The efficiency of the chopper can be expected in the range of _____%.
(A) 50 to 55 (B) 65 to 72 (c) 82 to 87 (D) 92 to 99

l) In a DC Choppers, the waveform for _____.

(A) input voltage is continuous and output voltage is discontinuous
(B) input voltage is discontinuous and output voltage is continuous
(C) input voltage and output voltage are continuous
(D) input voltage and output voltage are discontinuous

m) The effect of source inductance on the performance of the single phase and three phase full converter is to _____.

(A) reduce the ripple in the load current
(B) make discontinuous current as continuous
(C) reduce the output voltage
(D) increase the load voltage

n) In a three-phase controlled bridge rectifier, with an increase of an overlap angle, the output dc voltage _____.

(A) increases (B) decreases
(C) does not change (D) depends upon load inductance

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

Q-2		**Attempt all questions**	**(14)**
	a)	Illustrate the various protection scheme of power circuit.	**(3)**
	b)	Illustrate the various protection scheme for gating circuit of an SCR.	**(4)**
	c)	Discuss two transistor model of SCR and draw its VI Characteristics.	**(7)**
Q-3		**Attempt all questions**	**(14)**
	a)	Discuss Safe Operating Areas for MOSFET.	**(3)**
	b)	Discuss Safe Operating Areas for IGBT.	**(4)**
	c)	Give a general comparison of power semiconductor devices for Thyristor, TRIAC, power-MOSFET & IGBT.	**(7)**
Q-4		**Attempt all questions**	**(14)**
	a)	Draw basic structure, symbol and output characteristics of an IGBT.	**(3)**
	b)	Explain the operation of NPN-type Power BJT in CE-mode.	**(4)**
	c)	Write a comprehensive technical note on MCT	**(7)**

Q-5		**Attempt all questions**	**(14)**
	a)	Draw structure, symbol and characteristics of a TRAIC.	**(3)**
	b)	Explain four mode operation of TRIAC.	**(4)**
	c)	Discus on pulse transformer and optical isolation.	**(7)**
Q-6		**Attempt all questions**	**(14)**
	a)	Explain principal of operation of inverter.	**(3)**
	b)	Discuss series resonant inverter.	**(4)**
	c)	Explain 180-degree mode three phase inverter.	**(7)**
Q-7		**Attempt all questions**	**(14)**
	a)	What do you mean by freewheeling diode? When and where it is used?	**(3)**
	b)	Draw the circuit diagram and waveforms of single phase half controlled bridge converter with inductive load.	**(4)**
	c)	With the help of circuit diagram and waveform explain Single-phase to single -phase step-up cycloconverter- (mid-point).	**(7)**
Q-8		**Attempt all questions**	**(14)**
	a)	Explain single phase transformer taps changer.	**(3)**
	b)	Draw the circuit diagram and waveforms of single phase fully controlled bridge converter with resistive load.	**(4)**
	c)	Why three phase rectifiers are preferred over single phase rectifiers? A 3-phase half wave diode rectifier feeds to a resistive load R. Draw the various waveforms viz. supply voltage, output voltage, output current, input current and voltage across one of the diodes.	**(7)**