BRAINWARE UNIVERSITY

Term End Examination 2024-2025
Programme – Dip.EE-2022
Course Name – Power Electronics and Drives
Course Code - DEEPC501
(Semester V)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A
(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) Observe when a SCR is in the reverse blocking mode
   a) leakage current does not flow
   b) leakage current flows from anode to cathode
   c) leakage current flows from cathode to anode
   d) leakage current flows from gate to anode

(ii) Identify an SCR is turned off by
   a) reducing anode voltage and current to zero
   b) reducing gate voltage to zero
   c) gate is reverse biased
   d) none of these

(iii) Indicate an SCR circuit, the supply voltage is generally _____ that of breakover voltage.
   a) equal to
   b) less than
   c) greater than
   d) none of these

(iv) Predict when SCR is OFF, the current in the circuit is
   a) exactly zero
   b) small leakage current
   c) large leakage current
   d) none of these

(v) Observe an SCR circuit, the angle of conduction can be changed by
   a) changing anode voltage
   b) changing gate voltage
   c) reverse biasing the gate
   d) none of these

(vi) Tell the cause of an SCR is made up of silicon is
   a) silicon has a larger leakage current than germanium
   b) silicon has a smaller leakage current than germanium
   c) silicon has a smaller leakage voltage than germanium
   d) silicon has a larger leakage voltage than germanium

(vii) Write the effect of when the firing angle increase

a) both harmonic distortion and quality of input current increases
b) harmonic distortion increases and the quality of input current decreases
c) harmonic distortion decreases and the quality of input current increases
d) both harmonic distortion and quality of input current decreases

(viii) Select the correct option for firing angle, when the freewheeling diode comes in operation of a 3-phase semi-converter

a) is zero
b) is 60°
c) is more than 60°
d) is more than 90°

(ix) Write the phase relationship between ___ and ___ is controlled by varying the firing angle, for the method of phase control.

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

(x) Identify the waveforms for input and output voltages of a D.C. choppers are _____ respectively

a) discontinuous and continuous
b) continuous and discontinuous
c) both continuous
d) both discontinuous

(xi) Identify the condition to be satisfied for controllable power transfer for a step-up operation

a) $0 < Vs < E$
b) $0 < Vs > E$
c) $Vs > E$
d) $Vs < E$

(xii) Select correctly the load voltage of a chopper circuit can be controlled by varying the _____.

a) Duty cycle
b) Firing angle
c) Reactor position
d) All of these

(xiii) Observe the duty cycle, when chopper frequency is 1 kHz and ON time is 0.5 msec.

a) 0.6
b) 0.5
c) 0.8
d) none of these

(xiv) Predict the output voltage waveform is symmetrical about _____ in the negative half cycle for the single-pulse width modulation method.

a) 2π
b) $3\pi/2$
c) $\pi/2$
d) $3\pi/4$

(xv) Identify each step of the three-phase bridge inverter is

a) 30°
b) 60°
c) 90°
d) will depend on the value of the firing angle

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Define the commutation process of SCR. State the types of commutation. (3)
3. Explain firing angle and extinction angle. (3)
4. Write the application of PWM inverter. (3)
5. Define delay time and rise time of a SCR. (3)

6. A DC chopper operates on 230 volt DC and a frequency of 400 Hz, feeding R-L load. Evaluate the ON time of the chopper for an output of 150 volt. (3)

OR

Evaluate the conduction period and blocking period in each cycle of the thyristor in a chopper circuit. This circuit operates on the TRC principle at a frequency of 2 kHz on a 220 V DC supply. The load voltage is 170 V. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. For an SCR the gate-cathode characteristics have a straight line slope of 130. For triggering source voltage of 15 volt and allowable gate power dissipation of 0.5 watt. Examine the gate-source resistance. (5)

8. Design the net circuit diagram and waveform and explain the effect of the freewheeling diode in a single-phase half-controlled converter with R-L load. (5)

9. Explain about working of step up chopper with proper circuit diagram and waveform. (5)

10. Explain with circuit diagram and waveform single phase mid-point converter with R-L load. (5)

11. Discuss a single phase mid-point converter with R-L load in the connection with freewheeling diode with necessary circuit diagram and waveform. (5)

12. Calculate the load voltage when the blocking period of a step-up chopper is 40 micro-sec. This device operates on 220 V DC with a pulse width of 150 micro-sec. (5)

OR

Explain the working operation of the series inverter. (5)

****