



K. K. Wagh Institute of Engineering Education & Research, Nashik
(An Autonomous Institute From A.Y. 2022-23)

SUMMER-2024	
Exam Seat No.:	
Academic Year:2023-2024	Semester:IV
Class: SY BTech Electrical Engineering	Program:B.Tech Electrical Engineering
Branch Code:ELE	Pattern:2022
Name of Course:Power Electronics	Course Code:ELE222013
Max. Marks:60	Duration:2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 03 page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

Question No. 1 Attempt following Question

- 1 A single phase fully controlled converter fed from AC supply is used to control DC voltage across with RL load where inductance is very high to maintain constant current, draw the output voltage waveform for (6) CO2
- (i) Firing angle is 30 degree **–(2 Marks)**
 - (ii) Firing angle is equal to 90 degree **–(2 Marks)**
 - (iii) Firing angle is 150 degree **–(2 Marks)**

Question No. 2 Attempt following Question

- 2 The data sheet of SCR 2N6394 is given with the paper. From this data sheet fill in the blank (6) CO1
- (i) Maximum blocking voltage of SCR 2N6397=_____
 - (ii) On state rms output current= _____
 - (iii) Terminal 1=_____ Terminal 2=_____ Terminal 3 _____
 - (iv) Typical turn on time of SCR=_____
 - (v) Typical value of holding current= _____
 - (vi) dv/dt rating=_____

Question No. 3 Attempt following Question

- 3a) Draw the circuit diagram and waveform of buck converter and derive the equation for duty cycle? (8) CO2

OR

- 3b) Draw the circuit diagram and waveform of boost converter and derive the equation for duty cycle? (8) CO2

- 3c) Draw the circuit diagram and waveform for single phase voltage source inverter with sinusoidal pulse width modulation. Explain the working of the same (8) CO2


OR

- 3d) Draw the circuit diagram and waveform for three voltage source inverter with 120 degree of conduction. Explain the working of the same. (8) CO2

Question No. 4 Attempt following Question

- 4a) What are different techniques used to control the output voltage in voltage source inverter? Explain single pulse width modulation. Derive the formula of rms output voltage in single pulse width modulation. (8) CO3

OR

- 4b) A step up chopper is having input 100V and it used to control a motor of 200V. If on time of chopper is , calculate (8) CO3

(i) Duty cycle **(1 Marks)**

(ii) Switching frequency **(1 Marks)**

(iii) Output voltage, if the pulse width is reduced to half keeping switching frequency constant. **(3 Marks)**

(iv) Pulse width required, if the required output voltage is 150V with same switching frequency. **(3 Marks)**

- 4c) A single phase AC voltage regulator is used with to control output voltage with RL load. Derive (8) CO3

(i) the minimum firing angle—**(1Mark)**

(ii) rms output voltage—**(2Marks)**

(iii) current —**(2Marks)**

(iv) power—**(2Marks)**

(v) conduction angle of each thyristor—**(1Mark)**

OR

- 4d) Derive the instantaneous output voltage of single phase half bridge inverter using Fourier analysis and show that only odd harmonics are present in the output. (8) CO3

Question No. 5 Attempt following Question

5a) A single phase AC voltage regulator is used with R load. (8) CO3

(i) Derive the rms output voltage current and power for given circuit. (5 marks)

(ii) If input voltage is 230V, 50Hz and load is 500W at 200V, calculate rms output voltage and current. Firing angle is 90 degree. (3 marks)

OR

5b) For a single phase full bridge voltage source inverter is used to utilize solar energy. The output of solar PV cell is 72V. The load resistance is 10 Ohm. Calculate: (8) CO3

(i) rms output voltage (1 Marks)

(ii) fundamental rms output voltage (1 Marks)

(iii) fundamental output current (2 Marks)

(iv) Fifth harmonic voltage and current (2 Marks)

(v) Total harmonic distortion (THD) (2 Marks)

5c) Design a buck converter to transfer battery to motor of electric vehicle with following specifications (8) CO4
with circuit diagram

Battery output voltage=60V.

Motor specification= 1000W at 48V

Allowable ripple in output voltage 2% of average output voltage

Allowable in ripple in inductor current is 20%.

Switching frequency=50kHz

OR

5d) Design a buck boost converter with following specifications with diagram (8) CO4

Input voltage=50V

Output voltage=100V

Output power=1000W

Allowable ripple in output voltage 2% of average output voltage

Allowable in ripple in inductor current is 15% of load current.

Switching frequency=50kHz

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