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Question Paper Code : 40494

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Fifth Semester

Electrical and Electronics Engineering

EE 8552 — POWER ELECTRONICS

(Common to B.E. Mechatronics Engineering)

(Regulations 2017)

(Codes/Tables/Charts to be Permitted. If any may be Indicated)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is a Snubber circuit?
2. Define the threshold gate voltage of power MOSFET.
3. What is the relation between α , β and γ in single-phase fully controlled rectifier when operating with RL load?
4. What is the basic function of an excitation system?
5. What is a time ratio control?
6. What is meant by the regenerative braking in the battery-operated vehicles?
7. Define modulation index.
8. What are harmonics?
9. What is ON-OFF control in ac voltage controllers?
10. A three phase six-pulse, 50 kVA, 415V cycloconverter is operating at a firing angle of 45° and supplying load of 0.8 power factor. Determine input current to the converters.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Discuss the basic structure and working of power IGBT
(ii) Draw the two-transistor model of SCR and derive an expression for anode current.

Or

- (b) (i) Explain in details the different SCR commutation methods.
(ii) Discuss a typical driver circuit suitable for IGBT.
12. (a) Describe the working of 3- ϕ fully controlled bridge converter in the Rectifying mode and inversion mode. And derive the expression for average output voltage and rms output voltage.

Or

- (b) Explain the effect of source inductance in the performance of the single-phase fully controlled rectifier. (13)
13. (a) (i) With help of circuit diagram and waveforms explain the principle of working of boost converter (8)
(ii) For a class chopper working with resistive load of R ohms, input voltage of V_{dc} and duty cycle α , express the following variables as functions of R, V_{dc} and α .
- (1) Average output voltage and current
 - (2) Output current at the of commutation
 - (3) Average and RMS freewheeling diode currents
 - (4) RMS value of output voltage
 - (5) Average and RMS load currents. (5)

Or

- (b) (i) Describe the working of any one resonant dc to dc converter (5)
(ii) Explain the waveforms of type A chopper. Derive the expression for current ripple when it feeds RL load. (8)

14. (a) (i) With neat sketches, explain the operation of three phase voltage source inverter. Draw phase and line voltage waveforms on the assumption that each thyristor conducts for 120° and the resistive load is star connected. (10)
- (ii) Write short notes on the principle of UPS. (3)

Or

- (b) Explain the principle of space vector PWM applied to three phase VSI using the space vector diagram. (13)
15. (a) (i) Describe the operation of a 3-phase thyristorised AC voltage controller with neat power diagram and waveforms (8)
- (ii) Explain in detail about multistage control in ac voltage controllers. (5)

Or

- (b) (i) With the suitable circuit, discuss about the matrix converter (7)
- (ii) (1) Single phase AC voltage controller has, a resistive load of $R=10\Omega$ and input voltage is $V_s = 120 V$, $60 Hz$ the delay angle of thyristor T_1 is $\alpha = \frac{\pi}{2}$. Determine, the rms value of output voltage V_0 , the input PF and the average input current. (6)

PART C — (1 × 15 = 15 marks)

16. (a) (i) The buck regulator has an input range of $V_s=12V$. The regulated average output voltage is $V_a=5V$ at $R=500\Omega$ and the peak to peak output ripple voltage is $20mV$. The switching frequency is $25kHz$ if the peak to peak ripple current of inductor is limited to $0.8A$ determine
- (1) The duty cycle, K
- (2) The filter inductance, L
- (3) The filter capacitance, C and
- The critical value of L and C (10)

- (ii) A three phase fully controlled converter charges a battery from a three phase supply of 230V, 50Hz. The battery emf is 200V and its internal resistance is 0.5Ω . On account of inductance connected series with the battery, charging is constant at 20 A. Calculate (5)
- (1) firing angle
 - (2) supply power factor
 - (3) in case it is desired that power flows from dc source to ac load, find the firing angle for the same current.

Or

- (b) (i) The input to a three phase dual converter is 400V 50Hz. If peak value of circulating current is limited to a value 20 A find the value of inductance of the reactor for a firing angle of 60° (6)
- (ii) Draw the circuit diagram of 1ϕ auto sequential commutated current source inverter and explain its operation with equivalent circuits for different modes and necessary waveforms. (9)

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Question Paper Code : X10401

B.E./B.Tech. DEGREE EXAMINATIONS NOVEMBER / DECEMBER 2020

Fifth Semester

Electrical and Electronics Engineering

EE8552 - POWER ELECTRONICS

(Common to: Mechatronics Engineering)

(Regulations 2017)

Time: 3 Hours

Answer ALL Questions

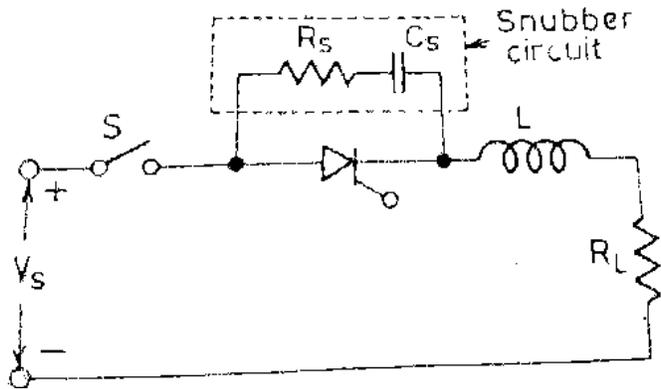
Max. Marks 100

PART- A (10 x 2 = 20 Marks)

1. Differentiate holding current from latching current
2. What do you mean by second breakdown in power BJT?
3. Define pulse number
4. Differentiate the device turn off time from the circuit turn-off time.
5. List the uses of class B chopper
6. What are the effects of quick or fast charging (storage) or high –energy recovery (discharge) from a battery?
7. What are integral body diodes?
8. Why PWM strategies are used in inverters?
9. What is bidirectional switch?
10. What is the disadvantage of ON-OFF control?

PART- B (5 x 13 = 65 Marks)

11. a) (i) Discuss the basic structure and working of power GTO. (6)
(ii) Figure shows a thyristor controlling the power in a load resistance R_L . The supply voltage is 240V dc and the specified limits for di/dt and dv/dt for the SCR are $50A/\mu\text{sec}$ and $300V/\mu\text{sec}$ respectively. Determine the values of the di/dt inductance and the snubber circuit parameters R_s and C_s .



(7)

OR

- b) (i) Draw the two transistor model of SCR and derive an expression for anode current. (6)
 (ii) Develop a UJT based Trigger circuit for SCR (7)

12. a) Show that the performance of a single – phase full converter as effected by source inductance is given by the relation

$$\cos(\alpha + \mu) = \cos \alpha - \frac{\omega L_s I_0}{V_m}$$

OR

- b) Describe the working of single –fully controlled bridge converter in the Rectifying mode and inversion mode. And derive the expressions for average output voltage and rms output voltage.

13. a) (i) With relevant sketches explain the operation of a buck-boost converter (8)
 (ii) With neat block diagrams, explain the principle of operation of battery operated vehicles. (5)

OR

- b) (i) The buck regulator has an input range of $V_s = 12V$. The regulated average output voltage is $V_a = 5V$ at $R=500\Omega$ and the peak to peak output ripple voltage is $20mV$. The switching frequency is 25 kHz if the peak to peak ripple current of inductor is limited to $0.8A$. Determine ,
 (a). The duty cycle
 (b). The filter inductance
 (c). The filter capacitance C , and
 (d). The critical value of L and C (5)

- (ii) Describe the working of four quadrant chopper (8)

14. a) (i)With neat sketches, explain the operation of three phase voltage source inverter. Draw phase and line voltage waveforms on the assumption that each thyristor conducts for 180° and the resistive load is star connected. (10)
 (ii) Write short notes on the principle of induction heating (3)

OR

- b) (i) With suitable circuits, mode diagrams and waveforms explain any one of CSI (9)
 (ii) Discuss about different modified SPWM strategies. (4)

15. a) (i). Describe the operation of a 3-phase thyristorised AC voltage controller with neat power diagram and waveforms.
 (ii). Explain in detail about multistage control in ac voltage controllers.

OR

- b) (i) With the suitable circuit, discuss about the matrix converter (7)
 (ii) For a single – phase voltage controller feeding a resistive load, show that power factor is given by the expression

$$\left[\frac{1}{\pi} \{(\pi - \alpha) + \frac{1}{2} \sin 2\alpha\} \right]^{1/2}$$

(6)

PART- C (1 x 15 = 15 Marks)

16. a) (i) A three phase fully controlled bridge converter operating from a 3 phase 220V, 50 Hz supply is used to charge a battery bank with nominal voltage of 240V. The battery bank has an internal resistance of 0.01Ω and the battery bank voltage varies by $\pm 10\%$ around its nominal value between fully charged and uncharged condition. Assuming continuous conduction find out.
 (a). The range of firing angle of the converter
 (b). The range of ac input power factor.
 (c). The range of charging efficiency. When the battery bank is charged with a constant average charging current of 100 Amps through a 250 mH lossless inductor. (10)
- (ii) The manufacturer of a selected diode gives the rate of fall of the diode current $di/dt=20A/\mu s$, and its reverse recovery time $t_r=5\mu$. What value of peak reverse current do you expect. (5)

OR

- b) (i) With help of suitable diagram explain the dynamic characteristics of Power diode (6)
 (ii) With neat circuit diagram explain the working of Class E Resonant Rectifier (9)

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Question Paper Code : 90206

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Fifth Semester

Electrical and Electronics Engineering

EE8552 – POWER ELECTRONICS

(Common to : Mechatronics Engineering)

(Regulations 2017)

Time : Three Hours

Maximum : 100 Marks

Codes/Tables/Charts to be permitted, if any may be indicated

Answer ALL questions

PART – A

(10×2=20 Marks)

1. List the different methods to turn on the SCR.
2. Define : threshold voltage of power MOSFET.
3. Write the relation between firing angle and extinction angle in single-phase fully controlled rectifier when operating with RL load.
4. Mention the output ripple frequency of 2 pulse, 3 phase and 6 pulse converter.
5. Name the two types of control strategies available for dc choppers.
6. Define duty cycle in dc chopper.
7. Compare free wheeling diode with feedback diode.
8. Why the THD has to be mitigated ?
9. Give the demerits of cyclo-converter.
10. What is matrix converter ?

PART – B

(5×13=65 Marks)

11. a) i) Discuss the basic structure and operation of power IGBT. (8)
ii) Explain the typical protection arrangement for a SCR. (5)

(OR)

- b) Describe the principles of different commutation methods of SCR.



12. a) i) Explain the effect of source inductance in the performance of the single-phase fully controlled rectifier. (10)
 ii) Write a short notes on light dimmer. (3)

(OR)

- b) Explain the working of three-phase fully controlled converter. Also show that this is suitable for two quadrant operation. (13)

13. a) i) Explain the principle of working of the buck-boost chopper with suitable waveforms and mode diagrams. (8)

- ii) Explain how the resonant converters differ from conventional hard switched converters. Also provide the different categories of resonant dc-dc converters. (5)

(OR)

- b) Explain the waveforms of type D chopper. Derive the expression for current Ripple when it feeds RL load.

14. a) Explain the principle of working of three phase VSI in 120° conduction mode with a star connected load. (13)

(OR)

- b) From the fundamental concept, explain the space vector modulation scheme suitable for three phase VSI. (13)

15. a) i) A single phase cycloconverter has input voltage of 230 V, 50 Hz and load of $R = 10 \Omega$. Output frequency is one-third of input frequency. For a firing angle delay of 30° , calculate :

- a) the rms value of output voltage
 b) the rms current value of each thyristor
 c) the input PF. (8)

- ii) Explain in detail about the ON/OFF control applicable to single phase ac voltage. (5)

(OR)

- b) i) Explain the two stage sequence control of single phase ac voltage controller. (7)

- ii) A single phase AC voltage full wave controller is employed for controlling the power flow from 230 V, 50 Hz source into a load circuit consisting of $R = 3 \Omega$ and $X_L = 4 \Omega$. Calculate :

- a) the control range of firing angle
 b) the maximum value of rms load current
 c) the maximum power and power factor. (6)

PART - C

(1×15=15 Marks)

16. a) Provide the detailed working of single phase capacitor commutated CSI with R load. Through a systematic analysis obtain the output current and voltage equations. Also mention the design considerations. (15)

(OR)

- b) i) The buck regulator has an input range of $V_s = 12$ V. The regulated average output voltage is $V_a = 5$ V at $R = 500 \Omega$ and the peak to peak output ripple voltage is 20 mV. The switching frequency is 25 KHz if the peak to peak ripple current of inductor is limited to 0.8 A, determine : (9)

- a) The duty cycle, K
 b) The filter inductance, L
 c) The filter capacitance, C and
 d) The critical value of L and C

- ii) A single phase AC voltage controller has a resistive load of $R = 10 \Omega$ and input voltage $V_s = 120$ V, 60 Hz the delay angle of thyristor T_1 is $\alpha = \frac{\pi}{2}$. Determine :

- a) the rms value of output voltage V_o
 b) the input PF and
 c) the average input current. (6)



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Question Paper Code : 41005

17/05/18

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B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018

Fifth Semester

Electrical and Electronics Engineering

EE 6503 – POWER ELECTRONICS

(Common to : Electronics and Instrumentation Engineering/Instrumentation and Control Engineering/Mechatronics Engineering)

(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

PART – A

(10×2=20 Marks)

1. What is meant by commutation of a SCR ?
2. Mention the advantages of 'RC' triggering over 'R' triggering.
3. List out the differences between full and semi converter.
4. Give the applications of fly wheel diode in a full converter.
5. What is meant by 'current limit control' of a chopper ?
6. What is a resonant converter ?
7. What is meant by 'space vector modulation' ?
8. Differentiate CSI over VSI.
9. List out the applications of AC voltage controller.
10. Mention the advantages of matrix converter over conventional converter.

PART – B

(5×13=65 Marks)

11. a) Explain the working of a current commutation technique. (13)
(OR)
b) Describe the UJT triggering circuit with neat sketch. (13)
12. a) Discuss the operation of a 3 phase semi converter with 'R' load and also draw the output voltage waveforms for 30° and 90°. (13)
(OR)
b) Explain the working of single phase full converter for 'RL' load discontinuous mode of operation with neat sketch and waveforms. (13)



13. a) With neat sketch and output voltage waveforms explain the working of a boost converter. (13)

(OR)

b) Describe the voltage commutated chopper with neat sketch. (13)

14. a) Discuss the working of a 3 phase inverter in 120° conduction mode. (13)

(OR)

b) Explain the SPWM and modified SPWM techniques for inverter switching. (13)

15. a) Explain the operation of a multi stage sequential control in single phase AC voltage controller. (13)

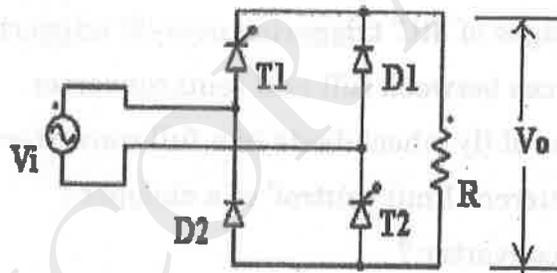
(OR)

b) Explain the operation of a three phase to three phase cyclo converter. (13)

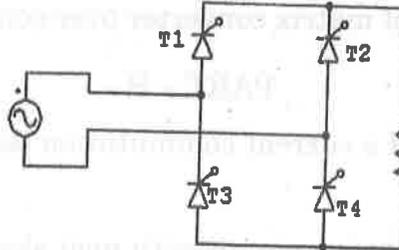
PART – C

(1×15=15 Marks)

16. a) i) Explain the working of the following circuits. Draw and find out the expression for output voltage. (8)



ii) In this single phase full converter T1 and T4 are given pulses at every ' α '. T2 and T3 are given pulses at every ' $\alpha + 180^\circ$ '. Unknowingly the gate pulses of T2 and T3 are removed and was given by the pulses of T1 and T2. Now explain, draw and derive the output voltage equation. (7)



(OR)

b) i) A single phase full converter is connected to 'R' load. The source voltage is of 230 V, 50 Hz. The average load current is of 20 A. For $R = 10 \Omega$, find the firing angle and also find the RMS output voltage. (8)

ii) A 2 kW, 400 V resistive load is connected to a three phase semi converter. The input to the converter is 400 V, 50 Hz. Find the load average voltage and current when the load consumes 1000 watts. (7)

Reg. No. :



Question Paper Code : 52958

B.E. B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Fifth Semester

Electrical and Electronics Engineering

EE 6503 – POWER ELECTRONICS

(Common to Electronics and Instrumentation Engineering, Instrumentation and Control Engineering, Mechatronics-Engineering)

(Regulation 2013)

(Also common to PTEE 6503 – Power Electronics for B.E. Part-Time – Fourth semester – Electrical and Electronics Engineering – Regulation 2014)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A – (10 × 2 = 20 marks)

1. What is meant by commutation of SCR and list its types?
2. What are the advantages of GTO over SCR?
3. Classify the different types of controlled Rectifier.
4. What is the function of freewheeling diode and state its advantages.
5. What is the effect of load inductance on the load current waveforms in the case of DC chopper?
6. What is the disadvantage of frequency modulated chopper?
7. Compare CSI and VSI.
8. Give the use of resonant switching in power electronic circuits.
9. What is integral cycle control ?
10. What are the different control techniques for AC regulator?

PART B — (5 × 13 = 65 marks)

11. (a) Explain the static and switching characteristics of IGBT and MOSFET. (13)

Or

(b) Explain why triac is rarely used in I quadrant with negative pulse and in III quadrant with positive pulse. (13)

12. (a) Explain the operating principle of a single phase full controlled bridge converter.

Or

(b) Explain the operating principle of three phase dual converter with necessary waveforms.

13. (a) Derive the expression for voltage gain in a dc – dc boost converter and explain the modes of operation with relevant waveforms.

Or

(b) Explain the working principle of voltage commutated chopper showing the current and voltage waveform across each device.

14. (a) Explain the operation of 3 phase bridge inverter for 120 degree mode of operation with phase and line voltage waveforms.

Or

(b) State different methods of voltage control in inverters. Describe about PWM control in inverter.

15. (a) Explain the working of three phase to single phase cycloconverter with neat circuit diagram and necessary waveforms.

Or

(b) (i) Write a short notes on matrix converter.

(ii) Explain the operation of single phase full wave A.C voltage regulator with help of voltage and current waveform.

PART C — (1 × 15 = 15 marks)

16. (a) A single-phase, half-wave rectifier with an AC voltage of 150 V has a pure resistive load of 9Ω . The firing angle α of the thyristor is $\frac{\pi}{2}$.

Determine the

- (i) Rectification efficiency
- (ii) Form factor
- (iii) Transformer derating factor
- (iv) Peak inverse voltage of the SCR
- (v) Ripple factor of the output voltage.

Assume that the transformer ratio is 2 : 1.

Or

(b) The series resonance turn-off circuit of Fig.16.b has the following data: $E = 160\text{ V}$, $L = 8\text{ MH}$, resistance of inductor coil $r_L = 0.2\Omega$, $R_{ld} = 0.6\Omega$ and $C = 65\mu\text{F}$.

Determine:

- (i) Derive an expression for the current $i(t)$.
- (ii) The pulse width and
- (iii) The time required for the capacitor voltage to attain a voltage equal to $1.7 E$.

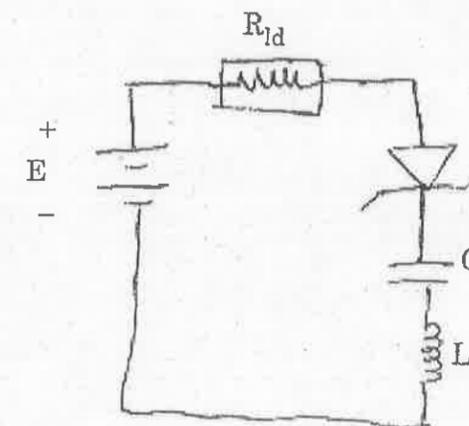


Fig.16.b

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F.N

Question Paper Code : 80379

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Fifth Semester

Electronics and Instrumentation Engineering

EE 6503 — POWER ELECTRONICS

(Common to Mechatronics Engineering, Electrical and Electronics Engineering,
Instrumentation and Control Engineering)

(Regulations 2013)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Specify the basic features of IGBT.
2. What is the purpose of using snubber circuit?
3. Classify the different types of controlled Rectifier.
4. What is the function of freewheeling diode and state its advantages.
5. What are the different classifications of chopper depending upon the direction of current and voltage?
6. What are the different control strategies in DC chopper?
7. Define modulation index and what is its use.
8. What are the applications of CSI?
9. Differentiate ON – OFF control and phase control in AC – AC converters.
10. What is cyclo converter?

PART B — (5 × 16 = 80 marks)

11. (a) Draw and explain the switching characteristics of a thyristor. (16)

Or

- (b) (i) Explain the operating principle of MOSFET. (8)
(ii) Explain the driver and snubber circuit for MOSFET. (8)

12. (a) With relevant wave forms, derive the expression for average and rms value of output voltage in a single phase full controlled converter with RL load. (16)

Or

- (b) (i) Explain the operating principle of single phase dual converter with neat waveforms. (10)
- (ii) A 1 phase full converter is feeding a RLE load with the source voltage of 230 V, the average load current is 10 A and $R = 0.4\Omega$, $L = 2mH$. Find the firing angle α for $E = 120V$ and $E = -120V$. (6)
13. (a) Derive the expression for voltage gain in a dc – dc boost converter and explain the modes of operation with relevant waveforms. (16)

Or

- (b) Explain the working principle of voltage commutated chopper showing the current and voltage waveform across each device.
14. (a) With the neat sketch and output waveforms, discuss the operation of three phase inverter operating in 180° mode. (16)

Or

- (b) (i) Comparison between Voltage source inverter and current source inverter. (8)
- (ii) Explain any one method to reduce the harmonic content in the inverter. (8)
15. (a) Explain the working of three phase to single phase cycloconverter with neat circuit diagrams and necessary waveforms. (16)

Or

- (b) Explain the working of two stage sequence control of AC Voltage controller. (16)

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Reg. No. :

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Question Paper Code : 50487

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017

Fifth Semester

Electrical and Electronics Engineering

EE6503 – POWER ELECTRONICS

(Common to : Electronics and Instrumentation Engineering/Instrumentation and Control Engineering/Mechatronics Engineering)

(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions

PART – A (10×2=20 Marks)



1. Why Triac is not popular as compared to SCR ? Justify.
2. What are the advantages of IGBTs ?
3. Distinguish between symmetric and asymmetric semiconductor configuration.
4. Define input power factor.
5. What is the effect of load inductance on the load current waveforms in the case of DC chopper ?
6. What is the disadvantage of frequency modulated chopper ?
7. State the necessity of return current diodes in inverter.
8. What is the function of feedback diodes in bridge inverter ?
9. Why is half wave AC voltage regulator not used ?
10. Explain the term sequence control of ac voltage regulators.

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PART – B

(5×13=65 Marks)

11. a) Explain the static and switching characteristics of IGBT and MOSFET. (13)
(OR)
b) Explain why triac is rarely used in I quadrant with negative pulse and in III quadrant with positive pulse. (13)
12. a) Explain the functional modes of dual converter with necessary diagrams. (13)
(OR)
b) Explain the operation of 3 phase fully controlled bridge rectifier with necessary waveforms. (13)
13. a) Explain the working of buck converter with neat waveform and also derive the expression of peak to peak voltage across the capacitor. (13)
(OR)
b) Explain the steady state analysis of step down chopper. (13)
14. a) Explain the operation of series resonant inverter. (13)
(OR)
b) Discuss the operation of 180° conduction of three phase inverter. (13)
15. a) Explain the operation of single phase to single phase cycloconverter. (13)
(OR)
b) Explain the operation of matrix converter. (13)

PART – C

(1×15=15 Marks)

16. a) A single-phase, half-wave rectifier with an AC voltage of 150 v has a pure resistive load of 9Ω . The firing angle α of the thyristor is $\frac{\pi}{2}$. Determine the
- Rectification efficiency
 - Form factor
 - Transformer derating factor
 - Peak inverse voltage of the SCR
 - Ripple factor of the output voltage.

Assume that the transformer ratio is 2 : 1.

(OR)

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50487

- b) The series resonance turn-off circuit of Fig. 16 b has the following data :
 $E = 160 \text{ v}$, $L = 8 \text{ MH}$, resistance of inductor coil $r_L = 0.2 \Omega$, $R_{Td} = 0.6 \Omega$ and $C = 65 \mu\text{F}$.

Determine :

- Derive an expression for the current $i(t)$.
- The pulse width and
- The time required for the capacitor voltage to attain a voltage equal to $1.7 E$.

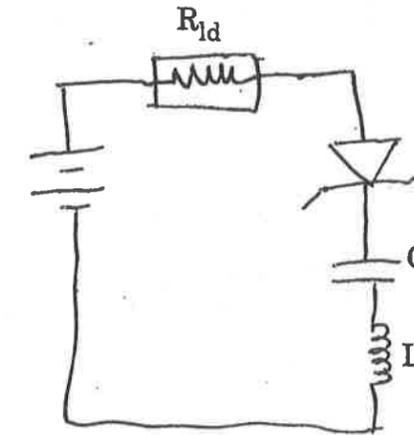


Fig. 16. b

Reg. No. :

(FN)

Question Paper Code : 20460

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Fifth Semester

Electrical and Electronics Engineering

EE 6503 — POWER ELECTRONICS

(Common to Electronics and Instrumentation Engineering, Instrumentation and Control Engineering, Mechatronics Engineering)

(Regulations 2013)

(Also common to PTEE 6503 — Power Electronics for B.E. (Part-Time) Fourth Semester — Electrical and Electronics Engineering — Regulations 2014)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. How is $\frac{di}{dt}$ and $\frac{dv}{dt}$ protection provided in SCR?
2. Mention the merits and demerits of GTO.
3. Why is the power factor of semi converters better than that of full converters?
4. What is the cause of circulating current in dual converters?
5. What are the advantages and disadvantages of a resonant pulse chopper?
6. A step up chopper is operated with a duty ratio of 0.6 for a dc input of 100 V. Determine the output voltage for a load resistance of $R_L = 5 \text{ ohm}$.
7. What are the purposes of feedback diodes in inverters?
8. What are the main differences between voltage-source and current-source inverters?
9. Mention merits and demerits of AC voltage controller.
10. What is a cycloconverter?

PART B — (5 × 13 = 65 marks)

PART C — (1 × 15 = 15 marks)

11. (a) (i) Explain the various types of turn ON methods of SCR. (8)
 (ii) Explain the design procedure of snubber circuit. (5)

Or

- (b) Explain the steady state and switching characteristics of MOSFET with aid of diagrams.

12. (a) Explain the operation of a single phase full converter with RLE load using relevant waveforms. Obtain the expressions for its average output voltage and RMS value of output voltage. (13)

Or

- (b) Explain the operation of single phase dual converter with aid of relevant waveforms. Obtain the expression of its instantaneous circulating current. (13)

13. (a) Draw the diagram of voltage commutated chopper and explain its operation with different mode diagrams and relevant waveforms. (13)

Or

- (b) With a neat power circuit diagram, explain the operation of boost converter. Draw the load voltage and load current waveforms and derive the expression for the output voltage. (13)

14. (a) Describe the principle of operation of three phase inverter operating in 120° conduction mode with necessary diagrams. (13)

Or

- (b) Explain the principle of operation of 3-φ auto sequentially commutated CSI with power circuit. Draw the equivalent circuits and relevant waveforms. (13)

15. (a) Describe the basic principle of working of single-phase to single-phase step down cycloconverter for both continuous and discontinuous conduction. (13)

Or

- (b) Draw the circuit diagram of single phase A.C. voltage controller with RL load. Explain the circuit operation with necessary waveforms. (13)

16. (a) The full-wave three-phase controlled rectifier has a three-phase 415 V, 50 Hz source (240 V phase), and provides a 100 A constant load current. Determine :

- (i) The average and rms thyristor current.
 (ii) The rms and fundamental line current.
 (iii) The fundamental apparent power. (15)

Or

- (b) For Type A step down chopper of dc source voltage = 230 V, load resistance = 10 ohm. Take a voltage drop of 2 V across chopper when it is on. For a duty cycle of 0.4, calculate (i) average and rms values of output voltage and (ii) chopper efficiency. (15)



Question Paper Code : 91493

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Fifth Semester

Electrical and Electronics Engineering

EE 6503 – POWER ELECTRONICS

(Common to Electronics and Instrumentation Engineering, Instrumentation and Control Engineering, Mechatronics Engineering)

(Regulations 2013)

(Also common to PTEE 6503 – Power Electronics for B.E. Part-Time – Electrical and Electronics Engineering – Fourth Semester – Regulations 2014)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions

PART – A

(10×2=20 Marks)

1. Define Holding current and Latching current in SCR.
2. Specify the basic features of IGBT.
3. Classify the different types of controlled rectifier.
4. Why is the power factor of semi converter better than that of full converters ?
5. What is meant by current limit control of a chopper ?
6. What is meant by space vector modulation ?
7. Differentiate VSI and CSI.
8. A single phase half bridge inverter feeds resistive load of 5Ω . When supply voltage of 120 V, determine the rms value of the fundamental component of output voltage.
9. Compare integral cycle control and phase control in AC voltage controllers.
10. List the applications of cyclo-converter.

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PART - B

(5×13=65 Marks)

PART - C

(1×15=15 Marks)

11. a) Draw and explain the switching characteristics of a thyristor. (13)

(OR)

b) i) Explain the operating principle of MOSFET. (7)

ii) Explain the driver and snubber circuit for MOSFET. (6)

12. a) Explain the operation of a single phase dual converter with aid of relevant waveforms. Obtain the expression of its instantaneous circulating current. (13)

(OR)

b) Explain the operation of a single phase full converter with RLE load using relevant diagrams. Obtain the expression for its average output voltage and RMS value of output voltage. (13)

13. a) Explain the working of Buck-Boost converter with necessary circuit and waveform and also derive the expression for its output voltage. (13)

(OR)

b) i) Explain the steady state analysis of step down chopper. (7)

ii) Explain the control strategies of chopper. (6)

14. a) With a neat sketch, explain the working of three phase bridge inverter in 180 degree mode of operation. (13)

(OR)

b) Explain the different methods of voltage control adopted in inverter with suitable waveforms. (13)

15. a) Describe the basic principle of 3 phase to 3 phase cyclo-converter with relevant circuit arrangements and RMS value of per phase output voltage. (13)

(OR)

b) i) Describe the working of single phase AC voltage controller with suitable power circuit and output waveform and derive its RMS and power factor value. (8)

ii) Write short notes on matrix converter. (5)

16. a) A single phase full wave AC voltage controller has an input of 230 V, 50 Hz and its feeding resistive load of 10 ohms. If firing angle of thyristor is 120 degree, find the output RMS voltage, input power factor and average current of thyristor. (15)

(OR)

b) A step down dc chopper has resistive load of $R = 10\Omega$ and input voltage $V_s = 200$ V. When the chopper remains ON, its voltage drop is 2 V for a duty of 0.6. Calculate :

i) Average and R.M.S. value of output voltage.

ii) Power delivered to load. (15)