V/SEM/E & TC/2019 (S) **[27-05-19, BACK]**

POWER ELECTRONICS AND INDUSTRIAL CONTROL

Sub Code – **ETT-501**

Full Marks: 70

Time: 3 hours

Answer any **FIVE** Questions

The figures in the right-hand margin indicate marks

1. (*a*) Define latching current and holding current. 2

(*b*) Explain the principle of operation of SCR with V-I characteristics of Thyristor. 5

(*c*) Explain the turn on methods of thyristor. 7

2. (*a*) Write down the types of protections of thyristor. 2

(*b*) Explain the operation of UJT Relaxation oscillator with a neat diagram. 5

(*c*) Explain gate triggering of SCR using UJT oscillator circuit. 7

3. (*a*) State the main functions of free-wheeling diode and why it is needed. 2

(*b*) Explain the operation of single phase half wave controlled rectifier with RL load and give its output diagram. 5

(*c*) Describe briefly about the snubber circuit and its essential. 7

4. (*a*) Classify the inverter according to the nature of input source. 2

(*b*) Explain the operation of single phase half bridge voltage source inverter with resistive load. 5

(*c*) Explain principle of step down and step up chopper operation. 7

5. (*a*) Classify choppers according to the directions of output voltage and current. 2

(*b*) Explain briefly about the constant frequency operation under the time ratio control strategy of chopper. 5

(*c*) Explain the operation of type A chopper. 7

6. (*a*) Describe cyclo-converter. 2

(*b*) Explain the basic structure of IGBT. 5

(*c*) Explain the operation of cyclo-converter with purely resistive load. 7

7. (*a*) Classify the power semiconductor devices and give two examples from each. 2

(*b*) Explain about the operation of buck converter. 5

(*c*) Explain briefly about the principle of online UPS. 7

V/SEM/E & TC/2018 (W) **[DEC, REG]**

POWER ELECTRONICS AND INDUSTRIAL CONTROL

Sub Code – **ETT-501**

Full Marks: 70

Time: 3 hours

Answer any **FIVE** Questions

The figures in the right-hand margin indicate marks

1. **(a)** List applications of SCR. [2]

(b) Explain the operation, construction of Power MOSFET & draw its characteristics curve. [5]

(c) Explain the operation, construction of IGBT and draw its characteristics curve. [7]

2. **(a)** State different methods of TURN ON of an SCR. [2]

(b) Explain the Auxiliary voltage commutations with neat circuit diagram and waveforms. [5]

(c) Explain synchronous triggering (ramp triggering). [7]

3. **(a)** Define Phase Angle, Extinction Angle of Controlled Rectifier. [2]

(b) Explain the principle of phase control and define firing angle (alpha) & conduction angle (beta) with the help of schematic and waveforms of Half wave controlled rectifier. [5]

(c) Explain with schematic diagram and waveforms the operation of single phase fully controlled bridge converter with RL load. [7]

4. **(a)** State the application of Chopper. [2]

(b) Explain different types of chopper configuration (Class A, Class B, Class C, Class D and Class F) briefly. [5]

(c) Explain principle of operation of Step Up and Down Chopper (Buck Boost Converts) [7]

5. **(a)** Define Inverter and State its Classification. [2]

(b) Draw the schematic diagram of single phase full bridge inverter (without commutation circuit) and explain its operation. [5]

(c) Explain a single phase to single phase Cycloconverter (Step Up and Step Down) with pure Resistive load with diagram and explain its waveform. [7]

6. **(a)** Give specification and ratings of Thyristors. [2]

(b) Describe how SCR can be protected against over voltage and over current. [5]

(c) Define Snubber Circuit and Design Snubber Circuit. [7]

7. **(a)** Define online UPS system and offline UPS system. [2]

(b) Draw schematic diagram of SCR battery charger with neat circuit diagram and explain. [5]

(c) Draw a block diagram of UPS system and explain its operation and application. [7]

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V/SEM/E & TC/2018 (S) **[02-05-18, BACK]**

POWER ELECTRONICS AND INDUSTRIAL CONTROL

Sub Code – **ETT-501**

Full Marks: 70

Time: 3 hours

Answer any **FIVE** Questions

The figures in the right-hand margin indicate marks

1. **(a)** Define Firing Angle and Extinction Angle of SCR. [2]
(b) With neat circuit diagram explain the working of Step-down Chopper. [5]
(c) Explain the construction, operation of SCR and draw its V-I characteristics curve. [7]

2. **(a)** Define Latching current and Holding current of SCR. [2]
(b) Draw the schematic diagram of a single phase half bridge voltage source inverter and explain Its operation. [5]
(c) With neat circuit diagram and waveforms explain briefly about RC-firing of SCR. [7]

3. **(a)** Differentiate between VSI and CSI. [2]
(b) Explain the construction, operation of GTO and draw its V-I characteristics curve. [5]
(c) With circuit diagram and waveforms explain the operation of fully controlled single phase Bridge converter with Restive load. [7]

4. **(a)** What is a freewheeling diode and why it is needed? [2]
(b) With neat diagram explain the Auxiliary Voltage Commutation circuit of SCR. [5]
(c) Describe the working of different Chopper Configurations (Type A, B, C and D only) [7]

5. **(a)** What is Solid State Relay? [2]
(b) Draw burglar alarm circuit using SCR and explain its operation. [5]
(c) Explain the operation of a single phase full bridge inverter with neat circuit diagram. [7]

6. **(a)** Draw the circuit diagram of UJT as an SCR Triggering circuit. [2]
(b) Describe briefly different Turn ON Methods of SCR. [5]
(c) Draw and explain the operation of a single phase to single phase Step-Up Cycloconverter with pure resistive load. [7]

7. **(a)** Write the full forms of IGBT, SMPS, TRC and BTBF. [2]
(b) Explain Snubber circuit, draw circuit diagram for protections of SCR by Snubber circuit. [5]
(c) Explain the operation of ON LINE and OF LINE UPS with a neat circuit diagram. [7]

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Collected By:-
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V/SEM/E & TC/2017 (W) **[07-12-17, REG]**

POWER ELECTRONICS AND INDUSTRIAL CONTROL

Sub Code – **ETT-501**

Full Marks: 70

Time: 3 hours

Answer any **FIVE** Questions

The figures in the right-hand margin indicate marks

1. **(a)** Write down the applications of power diode. [2]

(b) Explain Turn-ON & Turn-OFF behavior of power diode with current, voltage waveforms. [5]

(c) Explain construction, operation and V-I characteristics of a DIAC. Write down two applications of DIAC. [7]

2. **(a)** What are the different types of Power Transistor? [2]

(b) With neat diagram explain the two transistor analogy of SCR. [5]

(c) Explain the construction, operation and V-I characteristics of GTO. [7]

3. **(a)** What are the two general functions to be full filled by the gate control circuit? [2]

(b) Explain thermal triggering and radiation (light) triggering of an SCR. [5]

(c) What is commutation? What are the different types of commutation? Explain the line commutation circuit with waveforms. [7]

4. **(a)** What are firing angle (α), Conduction angle (γ) and Extinction angle (β)? [2]

(b) What is Integral Cycle Control (ICC)? [5]

(c) With neat circuit diagram and waveforms explain the operation of a single phase full-wave Controlled bridge convertor with resistive load. [7]

5. **(a)** What are the different types of choppers? [2]

(b) With neat circuit diagram and waveforms explain the operation of Buck-Boost Chopper. [5]

(c) With neat circuit diagram and waveforms explain the operation of Single Phase Full Bridge Voltage Source Inverter with Resistive Load. [7]

6. **(a)** Explain classification of cycloconverters. [2]

(b) What is duty cycle? Explain constant frequency method of controlling duty cycle of chopper.

(c) With neat circuit diagram and waveforms explain the operation of single phase to single Phase cycloconverter with resistive load. [7]

7. **(a)** What are electrical failures in an SCR. [2]

(b) What is a Snubber circuit? Explain how it protects the SCR? [5]

(c) Give a comparative explanation of Linear Power Supply and Switched Mode Power Supply. Give some applications of SMPS. [7]

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V/SEM/E & TC/2017 (S) **[18-05-17, BACK]**

POWER ELECTRONICS AND INDUSTRIAL CONTROL

Sub Code – **ETT-501**

Full Marks: 70

Time: 3 hours

Answer any **FIVE** Questions

The figures in the right-hand margin indicate marks

1.

a) Define holding current. [2

b) Draw the four layer structure of SCR. [5

c) Describe the different modes of operation of SCR. [7

2.

a) Write any two application of TRIAC. [2

b) Describe the working of a GTO. [5

c) Describe the light triggering and temperature triggering methods of SCR. [7

3.

a) What do you mean by commutation? [2

b) Describe any one of the forced commutation technique with neat sketch. [5

c) Describe how the Thyristor can be protected against overvoltage and over current. [7

4.

a) Draw the symbols of SCR, GTO and Power MOSFET. [2

b) Describe about the R-firing circuit. [5

c) Describe the working of a simple phase controlled rectifier circuit. [7

5.

a) What you mean by duty cycle? [2

b) What is a chopper? Explain the operation of step down chopper. [5

c) Explain the principle of operation of class-C chopper. [7

6.

a) Define turn-on time of SCR. [2

b) With necessary diagram describe the working of DIAC. [5

c) Describe the operation of a Burglar alarm circuit. [7

7.

a) What do you mean by firing angle? [2

b) Describe SSR. Explain its operation with neat diagram. [5

c) What is UPS? Explain the working of on-line and off-line UPS system. [7

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V/SEM/E & TC/2016 (W) **[DEC, NEW]**

POWER ELECTRONICS AND INDUSTRIAL CONTROL

Sub Code – **ETT-501**

Full Marks: 70

Time: 3 hours

Answer any **FIVE** Questions

The figures in the right-hand margin indicate marks

1.

a) Define firing angle and conduction angle of SCR. [2

b) Explain the two transistor analogy o SCR. [5

c) Explain the operation, construction of DIAC and draw the V-I characteristic. [7

2.

a) Write down the application of IGBT. [2

b) Explain the dynamic characteristic of SCR. [5

c) Explain the operation, construction of IGBT and draw its V-I characteristic.

3.

a) Define commutation. [2

b) What is firing circuit and draw and explain R-C firing circuit. [5

c) Explain line communication with circuit diagram and waveforms. [7

4.

a) Define Chopper. [2

b) Explain working fully controlled 1-Φ bridge converter of resistance load with waveforms.

c) Explain the operation of dual converter. [7

5.

a) Define inverter and its applications. [2

b) Explain the principle of operation of Buck-Boost converter. [5

c) Draw the diagram of a single phase to single phase cycloconverter with pure resistive load & explain with neat waveforms. [7

6.

a) Define Snubber circuit. [2

b) Define on-line UPS system. Draw block diagram of UPS system & explain its operation.

c) Describe (dv/dt) and (di/dt) protection of SCR. [7

7.

a) What is a freewheeling diode and why it is needed? [2

b) Explain static circuit breaker. [5

c) Draw schematic diagram of a single phase full bridge inverter & explain its operation. [7

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V/SEM/E & TC/2016(S) **[APR, BACK]**

POWER ELECTRONICS AND INDUSTRIAL CONTROL

Sub Code – **ETT-501**

Full Marks: 70

Time: 3 hours

Answer any **FIVE** Questions

The figures in the right-hand margin indicate marks

1. (a) Draw the circuit symbol of power MOSFET and IGBT. [2]
(b) Explain the operation, construction of SCR and draw its V-I characteristics curve. [5]
(c) Explain the operation, construction of IGBT and draw its characteristics curve. [7]

2. (a) List applications of TRIAC (Phase control using TRIAC). [2]
(b) Draw UJT pulse trigger circuit and explain. [5]
(c) Explain the Auxiliary Voltage Commutation with circuit diagram. [7]

3. (a) Define firing angle (alpha) and Conduction angle (beat) of controlled rectifier. [2]
(b) Explain principle of operation of Step up and Step down chopper. [5]
(c) Explain with circuit diagram and waveforms of the operation of fully controlled single phase bridge converter with Restive load. [7]

4. (a) Define inverter and its applications. [2]
(b) Draw the schematic diagram of single phase full bridge inverter (without commutation circuit) and explain its operation. [5]
(c) Draw the diagram of a single phase to single phase Cycloconverter (Step up and Step down) with pure Resistive load and explain and draw its waveform. [7]

5. (a) Define Cyclo converter and its applications. [2]
(b) Describe dv/dt and di/dt protection of SCR. [5]
(c) Design and explain Snubber Circuit and state its applications. [7]

6. (a) Define specification, ratings of Thyristor with example. [2]
(b) Draw a schematic diagram of SCR battery charger and explain. [5]
(c) Draw a block diagram of UPS system and explain its operation and applications. [7]

7. (a) Define only UPS system. [2]
(b) Draw diagram of AC voltage stabilizer and explain its operation. [5]
(c) Draw circuit diagram of Solid State Relay (SSR) and explain its operation [7]

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V/SEM/E & TC/2015(W) DEC New

POWER ELECTRONICS AND INDUSTRIAL CONTROL

Sub Code – **ETT-501**

Full Marks: 70

Time: 3 hours

Answer any **FIVE** Questions

The figures in the right-hand margin indicate marks

1. (a) Draw V-I Characteristics of Power, Signal and Ideal Diode. [2]
(b) Discuss the two transistor model of a thyristor. Derive an expression for the anode current. [5]
(c) Explain the constructional details and working of low power MOSFET and bring out difference between low power MOSFET and High power MOSFET. [7]

2. (a) Define Holding Current and Latching Current. [2]
(b) Explain the operation, construction and application of Power Diode. [5]
(c) Enumerate various mechanisms by which thyristors can be triggered into conduction mode. Discuss these techniques which result in random turn on of a Thyristor? [7]

3. (a) What is Snubber circuit and why it is essential? [2]
(b) Define commutation and explain the working of impulse communication method with neat circuit diagram and waveforms. [5]
(c) Explain different modes of operation, construction of TRIAC & draw its V-I characteristic. [7]

4. (a) Write down the application of phase controlled rectifiers. [2]
(b) With schematic diagram & waveforms, explain operation of 1ϕ semi converter with RL load.
(c) Describe the working of a single phase full bridge inverter with its advantages. [7]

5. (a) State the difference between voltage source and current source inverter. [2]
(b) Explain the principle of operation of step up chopper. [5]
(c) Describe the working of a single phase parallel inverter with relevant circuit & waveforms [7]

6. (a) Define Time ratio control. [2]
(b) Explain the principle of operation of single phase to single phase step up Cycloconverter with pure resistive load with the help of bridge type configuration. [5]
(c) Describe the working of different Chopper Configurations (Type A, B, C and D only) [7]

7. (a) What are the advantages of freewheeling diode? [2]
(b) Draw a block diagram of UPS system and explain its operation and applications. [5]
(c) Write short notes on way **TWO**: [4×2=8]
- **(i)** Buck Boost Converter
- **(ii)** Switch mode power supply (SMPS)
- **(iii)** GTO and its Applications.

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V/SEM/E & TC/2014(W)

POWER ELECTRONICS AND INDUSTRIAL CONTROL

(Sub Code: **Theory - 1)**

Full Marks: 80

Time: 3 hours

Answer any **FIVE** Questions

The figures in the right-hand margin indicate marks

1. (a) Define reliability of SCR and Mean Time Between Failure (MTBF). [2]

(b) Explain principle of operation of step-up chopper with resistive load and proper diagram and draw its waveform. [6]

(c) Explain the operation, construction of SCR and draw its V-I characteristics curve. [8]

2. (a) What is the basic difference between firing angle & extinction angle of controlled rectifier?[2

(b) Define commutation and explain briefly about different TURN ON methods of SCR. [6]

(c) Explain briefly about R-C firing of SCR. [8]

3. (a) Differentiate between DIAC and TRIAC. [2]

(b) Discuss about the operation of power BJT. [6]

(c) Describe about different chopper configurations (class A, B, C & D,) with neat diagrams. [8]

4. (a) What are the disadvantages of Cycloconverter? [2]

(b) Draw the schematic diagram of linear power supply that provides +5V or -5V and explain its operation. [6]

(c) Explain the operation of single-phase full bridge inverter with schematic diagram. [7]

5. (a) What do you mean by duty cycle? [2]

(b) Explain the operation with diagram of a single phase to single phase Cycloconverter with resistive type load. [6]

(c) Explain the operation, construction of GTO and draw its characteristics curve. [8]

6. (a) Differentiate between ONLINE UPS and OFFLINE UPS system. [2]

(b) Explain the two transistor of SCR. [6]

(c) Draw schematic diagram of linear power supply that provides +15V or -5V using IC LM 317 and explain its operation. [8]

7. (a) What are the methods to protect a SCR? [2]

(b) Explain with schematic diagram and waveform the operation of a single phase fully controlled bridge converter with resistive load. [6]

(c) Write short notes on way **TWO**: [4×2=8]

- **(i)** Smoke detector circuit
- **(ii)** Switch mode power supply (SMPS)
- **(iii)** Snubber circuit
- **(iv)** Uninterruptable power supply (UPS)

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V/SEM/E & TC/2013(W)

POWER ELECTRONICS AND INDUSTRIAL CONTROL

(Sub Code: **Theory - 1)**

Full Marks: 80

Time: 3 hours

Answer any **FIVE** Questions

The figures in the right-hand margin indicate marks

1. (a) Define holding current and surge current rating. [2]

(b) Explain the two transistor analogy of SCR. [6]

(c) Explain the operation, construction of TRIAC and draw V-I characteristics curve. [8]

2. (a) What are the applications of GTO? [2]

(b) Explain the operation, construction and application of Power Diode. [6]

(c) Explain the operation, construction of IGBT and draw its characteristics curve. [8]

3. (a) Define Reverse Recovery Time of SCR. [2]

(b) Define commutation and explain the working of Resonant commutation method with a neat circuit briefly. [6]

(c) Explain the R-Firing, R-C firing and Ramp Triggering circuit briefly. [8]

4. (a) Define phase angle and Extinction angle. [2]

(b) Explain with schematic diagram and waveform the operation of a single phase fully controlled bridge converter with Resistive load. [6]

(c) Draw the schematic diagram of single phase half bridge voltage source inverter and explain its operation. [8]

5. (a) Define Time Ratio Control. [2]

(b) Explain the principle of operation of step-down chopper with R-L load with a neat circuit diagram and give its waveform. [6]

(c) Describe the different chopper configurations (Class A, B, C & D only) [8]

6. (a) What are the advantages of Cycloconverter? [2]

(b) Draw the diagram of a single phase to single phase Cycloconverter with pure Resistive load and explain. [6]

(c) Design the Snubber circuit and why it is required. [8]

7. (a) What are three failures of SCR? [2]

(b) Define reliability of SCR and mean time between Failures (MTBF). [6]

(c) Draw a block diagram of UPS system and explain its operation and application. [8]

8. (a) What are the advantages of Fly Wheel Diode? [2]

(b) Draw a schematic diagram of linear power supply that provides + or -15V and explain its operation. [6]

(c) Write short notes on way two: - [4×2=8]

(i) Burglar alarm circuit

(ii) Solid State Relay

(iii) Temperature control circuit

(iv) SCR battery charger circuit.

V/SEM/E & TC/2012(W)

POWER ELECTRONICS AND INDUSTRIAL CONTROL

(Sub Code: **Theory - 1)**

Full Marks: 80

Time: 3 hours

Answer any **FIVE** Questions

The figures in the right-hand margin indicate marks

1. (a) Define Latching current and Holding current. [2]
(b) Explain operation, construction of power MOSFET & list of application of MOSFET. [6]
(c) Explain the operation, construction of TRIAC and draw its V-I characteristics curve. [8]

2. (a) How the GTO differs from a thyristor? [2]
(b) Define briefly different methods of TURN ON of an SCR. [6]
(c) Define commutation and explain the operation resonant communication method with neat circuit diagram and draw its waveform. [8]

3. (a) Define Phase angle and Extinction angle. [2]
(b) Define snubber circuit and design the snubber circuit. [6]
(c) Describe the working principle of single phase full-wave controlled rectifier with R-load with a neat diagram and draw waveform. [8]

4. (a) Define chopper and name of the devices which are used for implementation of chopper switch. [2]
(b) Explain briefly control strategies of chopper. [6]
(c) Explain principle the operation of step up & down chopper with a neat circuit diagram. [8]

5. (a) What is inverter and where it is used? [2]
(b) Explain the working principle the operation of single-phase full bridge inverter with a neat circuit diagram. [6]
(c) Explain the operation of a single phase to single phase Cycloconverter with resistive type load and what are the disadvantages of Cycloconverter? [8]

6. (a) Define Mean Time Between Failure. [2]
(b) Describe briefly overvoltage and over current protection of SCR briefly. [6]
(c) Explain the operation and working of switched mode power supply (SMPS) with a neat block diagram. [8]

7. (a) Define solid state relay. [2]
(b) Explain the operation and working of smoke detector circuit with neat block diagram. [6]
(c) Draw a block diagram of UPS system and explain its operation and application. [8]

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V/SEM/E & TC/2011(W)

POWER ELECTRONICS AND INDUSTRIAL CONTROL

(Sub Code: **Theory - 1)**

Full Marks: 80

Time: 3 hours

Answer any **FIVE** Questions Including Q No 1 and 2

The figures in the right-hand margin indicate marks

1. Answer any **TEN** Question : [2×10 = 20]

a) Define latching current and holding current.

b) What is trapped changes and why it is essential?

c) What is natural commutation and where it is used?

d) Define phase angle and extinction angle.

e) What is mean time between failures (MTBF)?

f) What is PWM control and why it is better than frequency modulation control in chopper?

g) What is inverter and where it is used?

h) What is SMPS and what are its advantages over voltage regulators?

i) Define reverse recovery time and gate recovery time.

j) What is chopper and where it is used?

2. Answer any ***FIVE*** Question : [6×5 = 30]

a) Draw the layer diagram of SCR & explain the operation, construction & application of it.

b) Explain the operation and construction of IGBT and its application.

c) Describe the general layout diagram of RC and UJT triggering firing circuit with neat circuit diagram.

d) Explain with schematic diagram and waveforms the operation of single phase fully controlled bridge converter with resistive load only.

e) Why snubber circuit is needed and design the snubber circuit with a neat circuit diagram both for DC and AC circuit.

f) Explain the operation of timer (ON AND OFF Daley) circuit using IC 555.

g) Draw the diagram of a single phase to single phase step-up Cycloconverter with Resistive load and explain its operation.

3. Explain the principle of operation of step down, step-up and step-down converter with a neat circuit diagram. [10]

4. Explain classification of inverter and explain the operation of single phase full bridge inverter (without communication circuit) with a help of neat and circuit diagram. [10]

5. Explain the operation of ON LINE and OF LINE UPS with a neat circuit diagram. [10]

6. (a) Draw the circuit diagram of Solid State Relay (SSR) and explain its operation. [5]

(b) Draw burglar alarm circuit using SCR and explain its operation. [5]

7. (a) Explain the operation, construction of GTO with a neat circuit diagram. [5]

(b) Explain the operation of +5 volt linear regulated power supply with the help of neat circuit diagram. [5]

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