

Scheme – I

Sample Question Paper

Program Name : Electronics Engineering Programme Group
Program Code : DE/EJ/ET/EN/EX/EQ/IS/IC
Semester : Fourth
Course Title : Basic Power Electronics
Marks : 70

22427

Time: 3 Hrs.

Instructions:

- (1) All questions are compulsory.
- (2) Illustrate your answers with neat sketches wherever necessary.
- (3) Figures to the right indicate full marks.
- (4) Assume suitable data if necessary.
- (5) Preferably, write the answers in sequential order.

Q.1) Attempt any FIVE of the following:-

10 Marks (5X2)

- (a) State two applications of IGBT .
- (b) Draw labeled symbol of DIAC and SCS.
- (c) Write the types of gate triggering.
- (d) Draw neat circuit diagram of single phase half wave controlled rectifier with R load.
- (e) List the types of inverters.
- (f) Define the term Chopper.
- (g) Draw the basic block diagram of SMPS.

Q.2) Attempt any THREE of the following:-

12 Marks (3X4)

- (a) Describe with neat sketch the operation of power MOSFET .
- (b) Describe with circuit diagram the operation of emergency lighting system.
- (c) Name a suitable chopper to increase the output voltage and also explain its operation with neat circuit diagram .
- (d) Explain with circuit diagram and waveform the operation of single phase half controlled rectifier with RL load.

Q.3) Attempt any THREE of the following.

12 Marks (3X4)

- (a) Explain with circuit diagram the operation of a suitable over current protection circuit for high power transistor.

- (b) Describe the effect of freewheeling diode with respect to single phase centre tap fully controlled rectifier with RL load.
- (c) Suggest a suitable type of inverter to produce square wave output and write its operation with neat circuit diagram.
- (d) Explain with circuit diagram the operation of a suitable circuit to control the temperature of a heater.

Q.4) Attempt any THREE of the following.

12 Marks (3X4)

- (a) Explain operation with circuit diagram a suitable type of triggering circuit to control the firing angle from 0° to 180° .
- (b) A single phase fully controlled rectifier supplied with voltage $v = 100\sin 314t$, $\alpha = 30^{\circ}$ and load resistance is 50Ω , find average output DC voltage and load current.
- (c) Explain operation with sketch a suitable chopper circuit to generate inverting voltage.
- (d) If a person use one ceiling fan (80W), two tube lights (40W per tube light), two CFL (7W per CFL) simultaneously with UPS having 12V, 150AH battery. Calculate backup time of UPS battery.
- (e) State the need of protection circuit and list its types.

Q.5) Attempt any TWO of the following.

12 Marks (2X6)

- (a) Explain with sketch the operation of IGBT.
- (b) Describe the operation of synchronized UJT triggering circuit with diagram.
- (c) Explain the operation of three phase half wave controlled rectifier with circuit diagram and also sketch its input and output waveform.

Q.6) Attempt any TWO of the following.

12 Marks (2X6)

- (a) Explain with a neat circuit diagram operation of series inverter.
- (b) Suggest a suitable power device having 1st and 3rd quadrant symmetrical characteristics and describe its operation with modes.
- (c) Explain with characteristics the effect of gate current on turn ON voltage of SCR.

Scheme – I

Sample Test Paper - I

Program Name : Electronics Engineering Programme Group
Program Code : DE/EJ/ET/EN/EX/EQ/IS/IC
Semester : Fourth
Course Title : Basic Power Electronics
Marks : 20

22427

Time: 3 Hour

Instructions:

- (1) All questions are compulsory.
- (2) Illustrate your answers with neat sketches wherever necessary.
- (3) Figures to the right indicate full marks.
- (4) Assume suitable data if necessary.
- (5) Preferably, write the answers in sequential order.

Q.1 Attempt any FOUR.

08 Marks (4X2)

- a) List out the merits of GTO over SCR.
- b) Draw the labeled characteristics of SBS.
- c) Draw two transistor equivalent circuit of SCR.
- d) Write four turn ON methods of SCR.
- e) For DC source, name any four turn OFF methods of SCR.

Q.2 Attempt any THREE.

12 Marks (3X4)

- (a) Explain with sketch the operation of SCS.
- (b) Interpret the VI characteristics of PUT.
- (c) Sketch circuit diagram of Class B commutation method. State function of each components
- (d) Justify the use of pulse transformer in SCR triggering .

Scheme – I

Sample Test Paper - II

Program Name : Electronics Engineering Programme Group
Program Code : DE/EJ/ET/EN/EX/EQ/IS/IC
Semester : Fourth
Course Title : Basic Power Electronics
Marks : 20

22427

Time: 1 Hour

Instructions:

- (1) All questions are compulsory.
- (2) Illustrate your answers with neat sketches wherever necessary.
- (3) Figures to the right indicate full marks.
- (4) Assume suitable data if necessary.
- (5) Preferably, write the answers in sequential order.

Q.1 Attempt any FOUR.

08 Marks (4X2)

- (a) State the relation between firing angle and conduction angle with wave form.
- (b) Write the effect of free wheeling diode in controlled rectifier.
- (c) List out the types of chopper.
- (d) Sketch the circuit diagram of series inverter.
- (e) Sketch circuit diagram of light dimmer circuit based on DIAC and TRIAC.

Q.2 Attempt any THREE.

12 Marks (3X4)

- (a) A single phase fully controlled rectifier supplied with voltage $v = 200\sin 314t$, $\alpha = 40^\circ$ and load resistance is 100Ω find average output DC voltage and load current.
- (b) Explain the operation of parallel inverter with neat sketch.
- (c) Explain with neat sketch the operation of battery charger using SCR.
- (d) List out the selection factors of SMPS.



22427

12223

3 Hours / 70 Marks

Seat No.

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- Instructions :**
- (1) All Questions are *compulsory*.
 - (2) Illustrate your answers with neat sketches wherever necessary.
 - (3) Figures to the right indicate full marks.
 - (4) Assume suitable data, if necessary.
 - (5) Use of Non-programmable Electronic Pocket Calculator is permissible.
 - (6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following :

5 × 2 = 10

- (a) Draw the symbol of IGBT and LASCR.
- (b) Define holding current and latching current.
- (c) List the types of turn-ON methods of SCR.
- (d) Draw circuit diagram of half wave controlled rectifier with resistive load.
- (e) Define Inverter. List the types of inverters.
- (f) State the types of Choppers.
- (g) Draw the circuit diagram of light dimmer circuit using DIAC.



2. Attempt any THREE of the following :**3 × 4 = 12**

- (a) Draw and describe V-I characteristics of SCR and indicate following parameters on the characteristics : (i) forward Breakover Voltage (V_{BO}) (ii) Reverse Breakdown Voltage (iii) Latching Current (iv) Holding Current :
- (b) Describe the working of battery charger using SCR with circuit diagram.
- (c) Describe the principle of operation of step-up chopper with circuit diagram and input-output waveforms.
- (d) Describe the operation of UJT triggering circuit of SCR with circuit diagram.

3. Attempt any THREE of the following :**3 × 4 = 12**

- (a) Describe the operation of single phase centre – tap full wave controlled rectifier with resistive load.
- (b) Draw circuit diagram and voltage-current waveform of single phase half wave controlled rectifier with Resistive Inductive (RL) load.
- (c) Describe series inverter with circuit diagram and waveform.
- (d) Describe with circuit diagram the operation of temperature controller using SCR.

4. Attempt any THREE of the following :**3 × 4 = 12**

- (a) Describe the working of class-A commutation of SCR with circuit diagram and waveforms.
- (b) Describe the operation of full wave centre tapped controlled rectifier with resistive load.

- (c) Draw the basic block diagram of UPS. Describe the following blocks : (i) Surge Suppressor (ii) Rectifier and charger (iii) Inverter (iv) Filter
- (d) Describe the working of step down chopper with circuit diagram and input – output waveforms.
- (e) List the different types of gate triggering methods and describe AC gate triggering circuit for SCR.

5. Attempt any TWO of the following :

2 × 6 = 12

- (a) Describe the working principle of POWER MOSFET using constructional diagram. Draw the V-I characteristics of power MOSFET and indicate cut off region, ohmic region and saturation region.
- (b) State the need of protection circuit of SCR. Describe the working of snubber circuit with circuit diagram.
- (c) Explain the operation of three phase half – wave controlled rectifier with circuit diagram. Also sketch its input output waveform.

6. Attempt any TWO of the following :

2 × 6 = 12

- (a) Describe with constructional details bidirectional working of TRIAC. Draw its V-I characteristics.
 - (b) Describe the operation of parallel inverter with circuit diagram and waveform.
 - (c) Describe the working principle of GTO with circuit diagram. State any two application of GTO.
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17444

11819

3 Hours / 100 Marks

Seat No.

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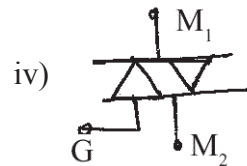
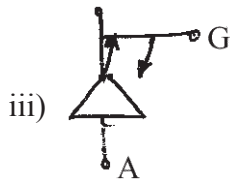
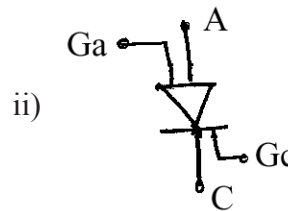
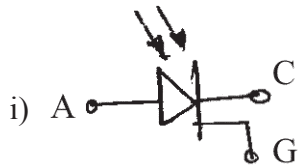
- Instructions :**
- (1) All questions are **compulsory**.
 - (2) Attempt **6** questions including Question No. **1** which is **compulsory**.
 - (3) Illustrate your answers with neat sketches **wherever** necessary.
 - (4) Figures to the **right** indicate **full** marks.
 - (5) Assume suitable data, if **necessary**.
 - (6) Use of Non-programmable Electronic Pocket Calculator is **permissible**.
 - (7) Mobile Phone, Pager and any other Electronic Communication devices are **not permissible** in Examination Hall.

Marks

1. A) Attempt **any six** of the following.

12

- a) Name four layer Thyristor family devices (Any two devices).
- b) List any two uses of IGBT.
- c) Identify the given symbols of Thyristor family devices :



- d) List any two applications of inverter.
- e) Draw resistance triggering circuit of SCR.
- f) Define chopper. Classify.
- g) State any two applications of controlled rectifiers.
- h) List any two advantages of SMPS.

P.T.O.



B) Attempt **any two** of the following.

- a) Compare single phase halfwave controlled rectifier and single phase full wave controlled rectifier (any four points).
- b) State four performance parameters of inverter.
- c) Draw the neat circuit diagram of emergency light system and write its working.

2. Attempt **any four** of the following.

16

- a) Why the controlled rectifiers are called phase controlled rectifiers ? Justify with neat sketch.
- b) Describe working of step-down chopper with neat diagram and waveforms.
- c) Draw the labelled circuit diagram of Battery charger using SCR.
- d) Define the following terms with respect to SCR :
 - i) Latching current
 - ii) Holding current
 - iii) On state voltage (V_{BO})
 - iv) Reverse Breakdown voltage (V_{BR}).
- e) Draw the circuit diagram of PUT relaxation oscillator and explain its operation.
- f) Explain working of step-up chopper with neat diagram.

3. Attempt **any four** of the following.

16

- a) Differentiate TRIAC and DIAC with respect to (1) symbol (2) layered diagram (3) application (4) breakdown voltage.
- b) Describe working of half wave controlled rectifier with Resistive load. Draw circuit diagram and waveforms.
- c) Define terms of GTO : (1) Turn off gain and (2) Maximum controllable I_A .
- d) Draw the construction of enhancement type power MOSFET and describe its working.
- e) Write the effect of inductive load and significance of free wheeling diode in 1ϕ bridge type full wave rectifier.
- f) A single phase full wave controlled rectifier is supplied with voltage $v = 210 \sin 314 t$. Find average output voltage and current. If firing angle is 50° and load resistance is 100Ω .

4. Attempt **any four** of the following.

16

- a) Describe working of $1 - \phi$ half bridge inverter with neat sketch.
- b) Explain four modes of operation of a TRIAC.
- c) With the help of circuit diagram explain speed control of fan using TRIAC – DIAC.
- d) Describe working of complementary symmetry commutation circuit with neat diagram.
- e) Draw the block diagram of UPS and explain function of each block.
- f) Compare step-up chopper and step-down chopper (any four points).



5. Attempt **any four** of the following.

- a) Draw the neat circuit diagram of low power dc flasher and describe its working.
- b) With the help of construction and equivalent circuit explain working of LASCR.
- c) State the need of polyphase rectifier.
- d) Draw circuit diagram of synchronized UJT triggering circuit and explain its working.
- e) Draw neat labeled VI characteristics of power transistor.
- f) Draw circuit diagram of centre tapped full wave controlled rectifier with RL load. Draw load voltage waveform for firing angle $\alpha = 30^\circ$.

6. Attempt **any four** of the following.

16

- a) Describe working of Temperature Controller with neat diagram.
 - b) Draw circuit diagram input and output waveforms of 3ϕ halfwave uncontrolled rectifier.
 - c) Compare natural commutation and forced commutation (any 4 points).
 - d) Draw constructional details of SCR. Why silicon is used as the intrinsic semiconductor for manufacturing the SCR ?
 - e) Compare between power MOSFET and IGBT (any four points).
 - f) Classify the commutation methods of thyristor. Draw class A commutation circuit.
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22427

21819

3 Hours / 70 Marks

Seat No.

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- Instructions* –
- (1) All Questions are *Compulsory*.
 - (2) Answer each next main Question on a new page.
 - (3) Illustrate your answers with neat sketches wherever necessary.
 - (4) Figures to the right indicate full marks.
 - (5) Assume suitable data, if necessary.
 - (6) Use of Non-programmable Electronic Pocket Calculator is permissible.
 - (7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

- 1. Attempt any FIVE of the following: **10****
- a) Define holding and latching current.
 - b) Draw the symbols of IGBT and PUT.
 - c) List different turn-on methods of SCR.
 - d) State the use of freewheeling diode in controlled rectifier.
 - e) List two applications of inverter.
 - f) Define Chopper. State its types.
 - g) Draw the basic block diagram of UPS.

P.T.O.

- 2. Attempt any THREE of the following:** **12**
- a) Describe with neat sketch the V.I characteristics of TRIAC.
 - b) Describe with circuit diagram the operation of battery charger using SCR.
 - c) Name a suitable chopper to decrease the output voltage and also explain its operation with neat circuit diagram.
 - d) Explain with circuit diagram and wave form the operation of single phase centre tapped full wave controlled rectifier with R load.
- 3. Attempt any THREE of the following:** **12**
- a) Explain class B commutation with neat circuit diagram.
 - b) A single phase full wave controlled rectifier is supplied with a voltage $V = 230 \sin 314t$. If firing angle ' α ' is 30° . Find:
 - (i) Average dc output voltage
 - (ii) Load current for the load resistance of 100Ω
 - c) Draw circuit diagram of step up chopper. State its output voltage expression and draw its input output waveforms.
 - d) Explain with circuit diagram the operation of emergency lighting system.
- 4. Attempt any THREE of the following:** **12**
- a) Explain with circuit diagram the operation of Class-C commutation.
 - b) Describe the operation of single phase half wave controlled rectifier with RL load.
 - c) Explain operation of series inverter with neat circuit diagram and waveform.
 - d) Draw and explain the block diagram of SMPS.
 - e) Compare R-triggering and RC-triggering of SCR (any four points).

- 5. Attempt any TWO of the following:** **12**
- a) Explain with sketch the operation of power MOSFET.
 - b) Describe the operation of PUT as relaxation oscillator.
 - c) Explain the operation of three phase half wave controlled rectifier with circuit diagram and also sketch its input and output waveform.
- 6. Attempt any TWO of the following:** **12**
- a) Explain with a neat circuit diagram the operation of parallel inverter.
 - b) Explain with characteristics the effect of gate current on break over voltage of SCR.
 - c) Draw labelled constructional diagram for GTO and describe its working principle with V-I characteristics.
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17444

21718

3 Hours / 100 Marks

Seat No.

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- Instructions :**
- (1) All Questions are *compulsory*.
 - (2) Answer each next main Question on a new page.
 - (3) Illustrate your answers with neat sketches wherever necessary.
 - (4) Figures to the right indicate full marks.
 - (5) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. (A) Answer any SIX :

2 × 6 = 12

- (a) Name any two triggering devices used for triggering SCR.
- (b) State any two advantages of IGBT.
- (c) List two applications of TRIAC.
- (d) State the classification of Chopper.
- (e) State difference between forced commutation and natural commutation.
(any 2 points)
- (f) List two applications of Inverter.
- (g) Define firing angle and conduction angle.
- (h) Draw labelled basic block diagram of UPS.

(B) Answer any TWO :

4 × 2 = 8

- (a) What is the polyphase rectifier ? State its need.
- (b) Compare between step up and step down chopper. (any 4 points)
- (c) Draw the neat circuit diagram of fan speed regulator using Triac.
Describe its working.

2. Answer any FOUR :**4 × 4 = 16**

- (a) Draw the single phase full wave bridge type controlled rectifier. Draw the waveforms of input voltage, load voltage and voltage across SCR.
- (b) Draw circuit of step down chopper and explain its working with neat waveforms.
- (c) State the function of SMPS. Sketch block diagram of SMPS and label it well.
- (d) Sketch equivalent circuit of SCR using BJT. Describe its working principle.
- (e) State different trigger methods and describe R-triggering method for SCR with circuit diagram and waveforms.
- (f) Define distortion factor and lowest order harmonics with respect to inverter.

3. Answer any FOUR :**4 × 4 = 16**

- (a) Differentiate SCR and TRIAC with respect to (i) symbol, (ii) layered diagram, (iii) operating quadrant, (iv) application.
- (b) Compare controlled and uncontrolled rectifiers. (any 4 points)
- (c) Draw constructional diagram of GTO and state its operating principle.
- (d) Draw VI characteristics of power transistor. Label different regions.
- (e) Describe the effect of free wheeling diode in controlled rectifier.
- (f) Sketch circuit of three phase uncontrolled half wave rectifier with resistive load. Draw its input and output waveforms.

4. Answer any FOUR :**4 × 4 = 16**

- (a) State the need of Inverter. List four applications of Inverters.
- (b) Draw symbol and characteristics of DIAC and SUS.
- (c) Describe the working of DC flasher circuit using SCR with neat diagram.
- (d) Explain dv/dt turn on method of SCR.
- (e) Draw the circuit diagram of light dimmer using DIAC and TRIAC and sketch the input and output voltage waveforms.
- (f) Draw circuit diagram of single phase half bridge inverter. Explain its working with output voltage waveforms.

5. Answer any FOUR :**4 × 4 = 16**

- (a) Draw labelled circuit diagram of battery charger using SCR.
- (b) Draw the layer diagram of PUT. With neat circuit diagram, describe its working as relaxation oscillator.
- (c) Draw 1ϕ HWCR with inductive load. Draw input and output waveforms. Describe its operation.
- (d) Describe the working of class B commutation with neat circuit diagram.
- (e) Draw the labelled constructional diagram of N-channel IGBT.
- (f) Draw the circuit diagram of three phase half wave controlled rectifier. Draw the waveforms of input voltage and output voltage.

P.T.O.

6. Answer any FOUR :**4 × 4 = 16**

- (a) Draw circuit diagram and explain the working emergency light system using SCR.
 - (b) Draw single phase centre tapped controlled rectifier with RL load and draw its load voltage waveforms.
 - (c) Explain class C commutation with circuit diagram.
 - (d) State two applications each for (i) SCR and (ii) PUT.
 - (e) Explain the secondary breakdown in power BJT and how it can be avoided ?
 - (f) Compare R-triggering and RC-triggering of SCR on the basis of (i) circuit diagram, (ii) firing angle, (iii) cost, (iv) average output voltage.
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22427

11920

3 Hours / 70 Marks

Seat No.

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- Instructions* – (1) All Questions are *Compulsory*.
- (2) Answer each next main Question on a new page.
- (3) Illustrate your answers with neat sketches wherever necessary.
- (4) Figures to the right indicate full marks.
- (5) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

- 1. Attempt any FIVE of the following. **10****
- a) Draw labeled symbol of SBS and PUT.
- b) State two applications of GTO.
- c) List the types of turn-off methods of SCR.
- d) Draw circuit diagram of single phase centre tapped full wave controlled rectifier with R. load.
- e) Define convertors and state it's types.
- f) Define term Inverter.
- g) Draw circuit diagram of light dimmer using DIAC - TRIAC

P.T.O.

- 2. Attempt any THREE of the following.** **12**
- a) Draw V-I characteristics of SCR. Define holding current and latching current.
 - b) Describe the working of Battery charger using SCR.
 - c) Describe the working principle of stepdown chopper using power MOSFET.
 - d) With neat sketch describe the operation of pulse transformer used in triggering circuit of SCR.
- 3. Attempt any THREE of the following.** **12**
- a) With help of circuit diagram and waveforms explain the working of single phase halfwave controlled rectifier with R-load.
 - b) Draw circuit diagram and input and out-put voltage waveforms of 3ϕ halfwave rectifier with resistive load.
 - c) Suggest the suitable type of Inverter to produce square wave output and write it's operation with neat diagram.
 - d) Draw block diagram of SMPS and state function of each block.
- 4. Attempt any THREE of the following.** **12**
- a) Describe the working of class C commutation with neat circuit diagram and waveforms.
 - b) A single phase fully controlled rectifier supplied with voltage $V = 100 \sin 314 t$, $\alpha = 30^\circ$ and load resistance is 50Ω . Find average output DC voltage and load current.
 - c) Describe the working of step-up chopper with neat circuit diagram.
 - d) With help of block diagram explain working of ONLINE UPS system.
 - e) List different Turn ON methods of SCR and explain any one in details.

5. Attempt any TWO of the following.**12**

- a) Suggest a suitable power device having 1st and 3rd quadrant symmetrical characteristics and describe its operation with modes.
- b) State the need of protection circuit of SCR describe the working of snubber circuit with neat diagram.
- c) Draw full-wave controlled rectifier with R-L load with Free Wheeling diode. Explain the effect of free wheeling diode on the circle with output voltage waveforms.

6. Attempt any TWO of the following.**12**

- a) Describe the working of series Inverter with neat diagram and state its two applications.
 - b) Describe the working of LASCR with its constructional diagram and state its two industrial applications.
 - c) With help of circuit diagram and V - I characteristics explain working principle of UJT and state its two applications.
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17444

11718

3 Hours / 100 Marks

Seat No.

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- Instructions :**
- (1) All Questions are *compulsory*.
 - (2) Answer each next main Question on a new page.
 - (3) Illustrate your answers with neat sketches wherever necessary.
 - (4) Figures to the right indicate full marks.
 - (5) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. (A) Attempt any SIX of the following :

12

- (a) Draw the symbols of (i) SCR (ii) DIAC
- (b) State advantages of power transistor (any two)
- (c) Define holding and latching current.
- (d) Define chopper. State its types.
- (e) List different turn-on methods of SCR.
- (f) State the applications of inverter.
- (g) State the use of free wheeling diode in controlled rectifiers.
- (h) Draw the circuit diagram of fan speed regulator using TRIAC.

(B) Attempt any TWO :

8

- (a) Compare controlled and uncontrolled rectifiers. (any four points)
- (b) Draw the circuit diagram and waveforms of step up chopper using MOSFET.
- (c) Draw the circuit diagram of light dimmer using DIAC and TRIAC and sketch the input-output waveforms.

2. Attempt any FOUR :**16**

- (a) Draw the circuit diagram input-output waveforms and explain the working of single phase half wave controlled rectifier with R load.
- (b) Draw and explain the circuit diagram of series inverter with waveforms.
- (c) Draw the circuit diagram of emergency lighting system using SCR and describe its working.
- (d) Draw and explain the VI characteristics of DIAC.
- (e) Explain SCR triggering using UJT with neat circuit diagram.
- (f) Compare step up and step down chopper. (any four points)

3. Attempt any FOUR :**16**

- (a) Compare SCR & TRIAC. (any four points)
- (b) Draw the neat circuit diagram and waveforms of single phase centre tapped full wave controlled rectifier with RL load.
- (c) Draw and explain the VI characteristics of power transistor.
- (d) Draw and explain the VI characteristics of VJT.
- (e) Draw the circuit diagram of single phase fully controlled bridge rectifier with R load. Draw the waveforms of input and output voltage.
- (f) Describe the need of polyphase rectifier.

4. Attempt any FOUR :**16**

- (a) Draw the circuit diagram and waveforms of step down chopper and explain it.
- (b) Draw and explain the VI characteristics of SCR.
- (c) Describe the working of DC flasher circuit using SCR with neat diagram.
- (d) Draw the neat block diagram of gate triggering. State the advantages of gate triggering.
- (e) Draw the circuit diagram of temperature controller using SCR with neat circuit diagram.
- (f) Draw the circuit diagram of three phase half wave uncontrolled rectifier. Draw its input and output waveforms.

5. Attempt any FOUR :**16**

- (a) Draw and explain the battery charger using SCR.
- (b) Draw the construction of GTO & explain the working principle.
- (c) Describe the operation of pulse transformer used in triggering circuits.
- (d) Explain RC triggering circuit with neat circuit diagram & waveforms.
- (e) Draw the symbol & vertical structure of power transistor and explain.
- (f) Define firing angle and conduction angle. What is the effect of firing angle on average output voltage ?

P.T.O.

6. Attempt any FOUR :**16**

- (a) Draw and explain the diagram of electronic timer using SCR.
 - (b) Draw the circuit diagram of three phase controlled half wave rectifier with R load. Draw its input and output waveforms.
 - (c) Draw & explain the class C commutation with neat circuit diagram and waveforms.
 - (d) Draw and explain the two transistor analogy of SCR.
 - (e) Describe the construction of IGBT.
 - (f) Define commutation. List various types of commutation.
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22427

21222

3 Hours / 70 Marks

Seat No.

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15 minutes extra for each hour

- Instructions :**
- (1) All Questions are *compulsory*.
 - (2) Answer each next main Question on a new page.
 - (3) Illustrate your answers with neat sketches wherever necessary.
 - (4) Figures to the right indicate full marks.
 - (5) Assume suitable data, if necessary.

Marks

1. Attempt any FIVE :

(5 × 2 = 10)

- (a) State two applications of power MOSFET.
- (b) Draw the symbol of PUT and GTO.
- (c) Define commutation and state its types.
- (d) Define inverter and state its types.
- (e) Draw the block diagram of UPS.
- (f) State two advantages of gate triggering.
- (g) Define firing angle and conduction angle.

2. Attempt any THREE :

(3 × 4 = 12)

- (a) Draw the constructional details of IGBT and mark the layers.
- (b) Describe the operation of a battery charger with neat diagram.
- (c) With a neat diagram explain the operation of step down chopper using MOSFET.
- (d) Draw and explain complementary commutation circuit.

3. Attempt any THREE : **(3 × 4 = 12)**

- (a) Draw the circuit diagram of 1 ϕ H.W.C. Rectifier with 'R' load. Explain the working with wave forms.
- (b) Draw and explain the operation of a triggering circuit to control the firing angle $0^\circ - 180^\circ$.
- (c) Draw and explain the operation of a light dimmer circuit using TRIAC & DIAC.
- (d) Suggest a suitable inverter to produce square wave output. Draw its neat circuit diagram.

4. Attempt any THREE : **(3 × 4 = 12)**

- (a) Draw and explain two transistor analogy of SCR.
- (b) A single phase full wave controlled rectifier is supplied with a voltage $V=100 \sin(314 t)$, $\alpha = 30^\circ$ and load resistance is 50Ω . Find the average output DC voltage and load current.
- (c) Describe the effect of free wheeling diode with respect to single phase center tapped fully controlled rectifier with RL load.
- (d) Draw and explain the operation of a temperature control circuit using SCR.
- (e) Draw the constructional detail of GTO. Explain its working principle.

5. Attempt any TWO : **(2 × 6 = 12)**

- (a) Draw the constructional details of TRIAC. State its mode of operation and explain its V-I characteristics.
- (b) Explain the operation of three phase half wave controlled rectifier with circuit diagram. Draw i/p – o/p wave forms.
- (c) Explain the operation of series inverter with neat circuit diagram. Draw the waveforms.

6. Attempt any TWO :**(2 × 6 = 12)**

- (a) (i) Define chopper. State its classification.
 - (ii) Compare step-down and step-up chopper [any four points].
 - (b) Describe the operation of synchronized UJT triggering circuit with circuit diagram.
 - (c) (i) Draw neat labelled diagram of V-I characteristics of SCR.
 - (ii) Explain the effect of gate current on turn on voltage of SCR.
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17444

16172

3 Hours / 100 Marks

Seat No.

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- Instructions :**
- (1) All Questions are *compulsory*.
 - (2) Answer each next main Question on a new page.
 - (3) Illustrate your answers with neat sketches wherever necessary.
 - (4) Figures to the right indicate full marks.
 - (5) Assume suitable data, if necessary.
 - (6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. (A) Attempt any SIX :

12

- (a) Draw the symbol of MOSFET and IGBT.
- (b) Draw the structural diagram and symbol of SCR.
- (c) List any four methods of triggering of SCR.
- (d) Define rectification. State any two devices used for rectification.
- (e) Give the classification of chopper. Define inverter.
- (f) Define any two performance parameters of inverter.
- (g) State the function of freewheeling diode in any rectifier circuit.
- (h) Define the term commutation of SCR.

- (B) Attempt any TWO :** **8**
- (a) Define holding current and latching current. State their typical values.
 - (b) Draw and explain single phase half wave controlled rectifier with resistive load. State the equations of average voltage and current.
 - (c) Draw and explain the block diagram of SMPS.
- 2. Attempt any FOUR :** **16**
- (a) Draw the characteristics of power BJT. Explain Quasi-saturation.
 - (b) Draw the characteristics and explain the working of SCS.
 - (c) Draw the structural diagram and symbol of GTO. Describe its working.
 - (d) Draw the circuit diagram of Resistance triggering. Explain the working with necessary waveforms.
 - (e) Define firing angle. Explain the method of phase control technique.
 - (f) Draw and explain step-down chopper with relevant waveforms.
- 3. Attempt any FOUR :** **16**
- (a) State the types of power MOSFETS. Explain the working of any one type with a constructional diagram.
 - (b) Compare SCR & TRIAC with any four points.
 - (c) Explain pulse triggering of SCR, with a neat circuit diagram and necessary waveforms.
 - (d) Draw the circuit diagram and waveforms of 3-phase half wave controlled rectifier.
 - (e) Give a detailed classification of inverters.
 - (f) Draw a fully controlled bridge configuration of single phase rectifier. Explain working with necessary waveforms.

4. Attempt any FOUR :**16**

- (a) Compare 'Power BJT' with 'Power MOSFET' for their performance factor, construction and area of applications.
- (b) Explain the working of "PUT" with relevant diagrams. Why it is called programmable ?
- (c) Explain Complementary Commutation with necessary diagrams and waveforms.
- (d) Draw a neat circuit diagram of single phase half bridge inverter. Explain with waveforms.
- (e) Draw and explain on-line UPS.
- (f) Compare three phase controlled and uncontrolled rectifier with resistive load, for any four points.

5. Attempt any FOUR :**16**

- (a) Name any four triggering devices. Draw the characteristics of "DIAC".
- (b) With necessary waveforms explain the turn-off mechanism of SCR.
- (c) Explain the principle of step up chopper with a neat diagram.
- (d) Draw the set-up of a temperature controller using SCR.
- (e) Draw and explain light dimmer circuit using DIAC-TRIAC.
- (f) With necessary diagrams explain how a freewheeling diode improves the power factor of a single phase half wave rectifier connected with inductive load.

P.T.O.

6. Attempt any FOUR :**16**

- (a) Draw the structure and symbol of SUS. State the difference between SUS and PUT.
 - (b) Explain resonant commutation with necessary waveforms.
 - (c) A single phase half wave controlled rectifier is supplied with a voltage $v = 110 \sin (.628 t)$. Find the average DC output voltage and current, if the firing angle is 15° and $R_L = 200 \Omega$.
 - (d) State the need of 3-phase rectifier. State the expression for average DC output voltage of a 3-phase controlled rectifier during,
 - (i) Continuous conduction mode
 - (ii) Discontinuous conduction mode
 - (e) Draw the circuit diagram of battery charger and state significance of each component.
 - (f) Draw electronic timer and state its working.
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17444

16117

3 Hours / 100 Marks

Seat No.

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- Instructions* – (1) All Questions are *Compulsory*.
- (2) Answer each next main Question on a new page.
- (3) Illustrate your answers with neat sketches wherever necessary.
- (4) Figures to the right indicate full marks.
- (5) Use of Non-programmable Electronic Pocket Calculator is permissible.
- (6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. a) **Attempt any SIX of the following:**

12

- (i) Draw symbols of SCS and SUS.
- (ii) State any two advantages of power MOSFET.
- (iii) Define holding current (I_H) and Latching current (I_L) of SCR.
- (iv) Give classification of Inverter.
- (v) State the importance of pulse transformer in triggering circuit.
- (vi) List any two applications of chopper.
- (vii) State the need of Polyphase Rectifier.
- (viii) Draw circuit diagram of light dimmer using DIAC-TRIAC.

P.T.O.

b) **Attempt any TWO of the following:**

8

- (i) Compare single phase half wave and three phase half wave uncontrolled Rectifiers based on.
 - 1) No. of diodes
 - 2) Output power
 - 3) Ripple present in output
 - 4) Output voltage waveform
- (ii) Define four performance parameters of an inverter.
- (iii) With the help of neat diagram explain operation of temperature controller using SCR.

2. **Attempt any FOUR of the following:**

16

- a) Describe working of single phase centre tapped full wave controlled Rectifier with Resistive load.
- b) With the help of circuit diagram and waveforms explain step down chopper using power MOSFET.
- c) Draw block diagram of UPS. Explain each block in detail.
- d) Draw VI characteristics of SCR. State the effect of increasing gate current of SCR.
- e) What are different Turn ON methods of SCR? Explain dv/dt triggering.
- f) Describe working of single phase half bridge inverter with help of neat circuit diagram and waveforms.

3. **Attempt any FOUR of the following:**

16

- a) Compare UJT and DIAC w.r.t.
 - (i) symbol
 - (ii) layer diagram
 - (iii) operating quadrant
 - (iv) application

- b) Draw circuit diagram, input and output waveforms for single phase half controlled Rectifier with RL load.
- c) Define following w.r.t. GTO.
 - (i) Maximum controllable Anode current
 - (ii) Turn off gain.
- d) Draw neat labeled characteristics of power transistor. Show its regions.
- e) Define firing angle (α) and conduction angle (θ). State effect of changing firing angle (α) on output voltage of Rectifier.
- f) A single phase full wave controlled Rectifier is supplied with a voltage $V_S = 300 \sin (314 t)$. Find average output voltage and current if firing angle is 60° and load resistance is 500Ω .

4. Attempt any FOUR of the following:

16

- a) With the help of circuit diagram and waveform explain set-up chopper.
- b) Explain four modes of operation of TRIAC with neat constructional diagram.
- c) Draw block diagram of SMPS. State its advantages over linear regulators.
- d) What is commutation? Explain class C commutation with neat diagram.
- e) Describe working of emergency lighting system with neat circuit diagram.
- f) Compare step up and step down chopper based on
 - (i) Position of chopper switch
 - (ii) Output voltage
 - (iii) Expression of output voltage
 - (iv) Application

5. Attempt any FOUR of the following:**16**

- a) Draw circuit diagram of low power DC flasher. List any two applications.
- b) Describe constructional details of PUT. Why it is called programmable?
- c) Draw circuit diagram of three phase half wave controlled Rectifier. Draw its input and output voltage waveforms.
- d) Explain RC triggering of SCR with neat circuit diagram.
- e) Draw neat labeled construction of IGBT. State any two advantages.
- f) Compare Uncontrolled and Controlled Rectifiers (Any four points)

6. Attempt any FOUR of the following:**16**

- a) Explain operation of Electronic timer using SCR. Give any two applications.
 - b) Describe working of fully controlled bridge rectifier with RL load.
 - c) What is class B commutation? Explain its operation with neat diagram.
 - d) Draw layered diagram of LASCR. What is the effect of increasing intensity of light? State any two applications.
 - e) Compare power transistor and power MOSFET w.r.t.
 - (i) symbol
 - (ii) switching speed
 - (iii) SiO₂ layer
 - (iv) on state loss
 - f) Draw circuit diagram of UJT Relaxation oscillator. Draw output waveform and give expression for frequency of oscillation.
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22427

21222

3 Hours / 70 Marks

Seat No.

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15 minutes extra for each hour

- Instructions :**
- (1) All Questions are *compulsory*.
 - (2) Answer each next main Question on a new page.
 - (3) Illustrate your answers with neat sketches wherever necessary.
 - (4) Figures to the right indicate full marks.
 - (5) Assume suitable data, if necessary.

Marks

1. Attempt any FIVE :

(5 × 2 = 10)

- (a) State two applications of power MOSFET.
- (b) Draw the symbol of PUT and GTO.
- (c) Define commutation and state its types.
- (d) Define inverter and state its types.
- (e) Draw the block diagram of UPS.
- (f) State two advantages of gate triggering.
- (g) Define firing angle and conduction angle.

2. Attempt any THREE :

(3 × 4 = 12)

- (a) Draw the constructional details of IGBT and mark the layers.
- (b) Describe the operation of a battery charger with neat diagram.
- (c) With a neat diagram explain the operation of step down chopper using MOSFET.
- (d) Draw and explain complementary commutation circuit.

3. Attempt any THREE : (3 × 4 = 12)

- (a) Draw the circuit diagram of 1 ϕ H.W.C. Rectifier with 'R' load. Explain the working with wave forms.
- (b) Draw and explain the operation of a triggering circuit to control the firing angle $0^\circ - 180^\circ$.
- (c) Draw and explain the operation of a light dimmer circuit using TRIAC & DIAC.
- (d) Suggest a suitable inverter to produce square wave output. Draw its neat circuit diagram.

4. Attempt any THREE : (3 × 4 = 12)

- (a) Draw and explain two transistor analogy of SCR.
- (b) A single phase full wave controlled rectifier is supplied with a voltage $V=100 \sin(314 t)$, $\alpha = 30^\circ$ and load resistance is 50Ω . Find the average output DC voltage and load current.
- (c) Describe the effect of free wheeling diode with respect to single phase center tapped fully controlled rectifier with RL load.
- (d) Draw and explain the operation of a temperature control circuit using SCR.
- (e) Draw the constructional detail of GTO. Explain its working principle.

5. Attempt any TWO : (2 × 6 = 12)

- (a) Draw the constructional details of TRIAC. State its mode of operation and explain its V-I characteristics.
- (b) Explain the operation of three phase half wave controlled rectifier with circuit diagram. Draw i/p – o/p wave forms.
- (c) Explain the operation of series inverter with neat circuit diagram. Draw the waveforms.

6. Attempt any TWO :**(2 × 6 = 12)**

- (a) (i) Define chopper. State its classification.
 - (ii) Compare step-down and step-up chopper [any four points].
 - (b) Describe the operation of synchronized UJT triggering circuit with circuit diagram.
 - (c) (i) Draw neat labelled diagram of V-I characteristics of SCR.
 - (ii) Explain the effect of gate current on turn on voltage of SCR.
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17444

21314

3 Hours / 100 Marks

Seat No.

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- Instructions* – (1) All Questions are *Compulsory*.
- (2) Answer each next main Question on a new page.
- (3) Illustrate your answers with neat sketches wherever necessary.
- (4) Figures to the right indicate full marks.
- (5) Assume suitable data, if necessary.
- (6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.
- (7) Preferably write the answer in sequential order.

Marks

1. a) Answer any **SIX** of the following: **12**
- i) Draw the symbols of:
- 1) UJT
- 2) TRIAC
- ii) State two advantages of IGBT.
- iii) List two applications of TRIAC.
- iv) Write classification of choppers.
- v) What are the limitations of R triggering circuit?
- vi) List applications of inverters. (Any four)

P.T.O.

- vii) State the need of polyphase rectifiers.
- viii) Draw the block diagram of SMPS and label it.

b) Answer any **TWO** of the following:

08

- i) A single phase full controlled bridge rectifier is supplied with voltage $v = 230 \sin (314 t)$; and is delivering power to a resistive load. Find the average output voltage, if the firing angle $\alpha = 45^\circ$.
- ii) Define inverter. Give classification of inverters.
- iii) Define the following terms with respect to inverters.
 - 1) Harmonic factor of n^{th} harmonic
 - 2) Total harmonic distortion
 - 3) Distortion factor
 - 4) Lowest order harmonics

2. Answer any **FOUR** of the following:

16

- a) Define firing angle and conduction angle. What is the effect of firing angle on average output voltage?
- b) Draw the circuit diagram of step up chopper. State its operating principle.
- c) Draw the block diagram of UPS. State the function of each block.
- d) Draw the constructional details of DIAC. Draw the VI characteristics of DIAC.
- e) Draw the circuit diagram of full wave RC triggering circuit to turn ON the thyristor. Draw the waveforms of input voltage and output voltage.
- f) Draw the circuit diagram of series inverter. Draw the input and output waveforms.

3. Answer any FOUR of the following:**16**

- a) Differentiate between SCR and TRIAC on the basis of :
 - i) symbol
 - ii) layered diagram
 - iii) operating quadrant and
 - iv) applications
- b) Draw the circuit diagram of single phase half wave controlled rectifier with R load. Draw the waveforms of input voltage, load voltage and voltage across SCR.
- c) Draw the VI characteristics of SCR. State the effect of gate current on the breakover voltage.
- d) Draw the VI characteristics of power transistor. Label different regions.
- e) Draw the single phase full wave bridge type controlled rectifier. Draw the waveforms of input voltage, load voltage and voltage across SCR.
- f) Differentiate between controlled and uncontrolled rectifiers.
(Any four points)

4. Answer any FOUR of the following:**16**

- a) Draw the circuit diagram of step down chopper. Draw the input output waveforms.
- b) Draw the constructional diagram of GTO. State the operating principle.
- c) Draw the circuit diagram of light dimmer using DIAC and TRIAC and sketch the i/p - o/p voltage waveforms.
- d) Draw the circuit diagram of class C commutation circuit.
Draw the waveforms.

- e) Draw the circuit diagram of a battery charger. State its operation.
- f) Compare between step up and step down chopper with respect to:
 - i) Input and output waveforms
 - ii) Output voltage equation
 - iii) Switch position (connection)
 - iv) Applications

5. Answer any FOUR of the following:

16

- a) Draw the neat circuit diagram of Fan Speed Regulator using TRIAC. Describe its working.
- b) Draw the VI characteristics of LASCR. What is the effect of light intensity on forward breakover voltage?
- c) Describe the effect of freewheeling diode with respect to single phase centre tap full controlled rectifier with RL load.
- d) Describe the operation of pulse transformer used in triggering circuits.
- e) Draw the labelled constructional diagram of N-channel IGBT.
- f) Differentiate between single phase controlled half wave rectifier and single phase controlled full wave rectifier.

6. Answer any FOUR of the following:**16**

- a) Draw the circuit diagram of DC low power flasher. Describe its operation.
 - b) Draw the circuit diagram of three phase half wave controlled rectifier. Draw the waveforms of input voltage and output voltage.
 - c) What is forward voltage triggering method of turning on the thyristor?
 - d) State two applications each for :
 - i) SCR
 - ii) PUT
 - e) What is the second breakdown in power BJT? How is it avoided?
 - f) Draw the circuit diagram of synchronized UJT triggering and describe its working.
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17444

21314

3 Hours / 100 Marks

17444

14115

3 Hours / 100 Marks

Seat No.

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- Instructions :** (1) All Questions are *compulsory*.
(2) Answer each next main Question on a new page.
(3) Illustrate your answers with neat sketches wherever necessary.
(4) Figures to the right indicate full marks.
(5) Use of Non-Programmable Electronic Pocket Calculator is permissible.
(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. (A) Attempt any SIX :

12

- (i) Draw the symbols of (a) IGBT (b) PVT (c) LASCR (d) GTO.
- (ii) State any two advantages of IGBT.
- (iii) Draw static characteristics of UJT and define peak point voltage.
- (iv) Define chopper. Classify it.
- (v) Compare forced commutation and natural commutation (any 2 points).
- (vi) Define inverter and classify it.
- (vii) Draw and label single phase centre tapped full wave controlled rectifier with resistive load.
- (viii) Draw labelled block diagram of SMPS. List 2 applications.



P.T.O.

(B) Attempt any TWO :**8**

- (i) Compare controlled and uncontrolled rectifier (any 4 points).
- (ii) Draw step down chopper circuit. State how O/P is related with duty cycle.
- (iii) Draw the labelled circuit diagram of emergency light system.

2. Attempt any FOUR :**16**

- (i) Draw the circuit diagram of 3- ϕ HW rectifier. Sketch the I/P & O/P waveforms for resistive load.
- (ii) Compare between step up & step down chopper (any 4 points).
- (iii) State the working principle of temperature controller circuit using SCR with neat diagram.
- (iv) Draw labelled V-I characteristics of SCR & define (a) Holding current, (b) Latching current.
- (v) Draw class-C commutation circuit. Describe its working with waveform.
- (vi) Draw 1- ϕ HWCR with inductive load. Draw I/P & O/P waveforms. Describe its operation.

3. Attempt any FOUR :**16**

- (i) Differentiate between SCR & TRIAC w.r.t. (a) symbol (b) layer diagram (c) static characteristics (d) applications.
- (ii) Draw 1- ϕ FW bridge controlled rectifier with resistive load. Draw waveforms at (a) I/P (b) Load.
- (iii) Draw equivalent circuit of SCR using BJT. Describe its working principle.
- (iv) Draw the VI characteristics of power transistor and show different operating regions in it, also state what is primary and secondary break down in it.

- (v) Draw the circuit diagram of 1- ϕ half controlled bridge rectifier with resistive load. Sketch I/P and O/P waveforms. Explain its operation.
- (vi) A 1- ϕ FWCR is supplied with a voltage $V = 230 \sin 314 t$. If firing angle ' α ' is 30° find (a) Avg. dc O/P volt. & (b) Current for the load resistance of 100Ω .

4. Attempt any FOUR :

16

- (i) Draw the neat circuit diagram of step-up chopper. Describe its working with waveforms.
- (ii) Draw the layer diagram of PUT. With neat circuit diagram describe its working as relaxation oscillator.
- (iii) Draw the block diagram of UPS. Explain its working principle in brief.
- (iv) State different triggering methods of SCR. Describe RC triggering method with circuit diagram.
- (v) Draw and describe the operation of light dimmer using DIAC & TRIAC.
- (vi) Show how the O/P volt of step-down chopper can be varied. State its O/P voltage expression and draw its input output waveforms.

5. Attempt any FOUR :

16

- (i) Draw neat circuit diagram of battery charger using SCR. Describe its working.
- (ii) Draw V-I characteristics of PUT & describe the role of its operating regions.
- (iii) Elaborate the term polyphase rectifier. Describe its need.
- (iv) Draw and explain SCR triggering using UJT with the help of pulse transformer. List its advantages.
- (v) Draw labelled layer diagram of n-ch. IGBT. Draw its V-I characteristics.
- (vi) Compare 1 ϕ HWCR & 1 ϕ FWCR on the basis of (a) No. of SCR diode used, (b) O/P waveform, (c) firing circuit complexity, (d) application.

6. Attempt any FOUR :**16**

- (i) Describe the working principle of controlling the speed of fan using TRIAC.
 - (ii) Describe the effect of freewheeling diode in controlled rectifiers.
 - (iii) Draw labelled circuit diagram of class A and class B commutation circuit for SCR.
 - (iv) Draw (layer) constructional diagram of GTO. Describe its operating principle.
 - (v) Compare power transistor and power MOSFET on the basis of (a) Symbol, (b) Layer diagram, (c) SiO₂ layer, (d) Switching speed.
 - (vi) Compare R-triggering and RC-triggering of SCR on the basis of (a) Circuit diagram, (b) Firing angle ' α ', (c) Cost, (d) Avg. O/P volt.
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17444

21415

3 Hours / 100 Marks

Seat No.

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- Instructions :** (1) All Questions are *compulsory*.
(2) Illustrate your answers with neat sketches wherever necessary.
(3) Figures to the right indicate full marks.
(4) Assume suitable data, if necessary.
(5) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.
(6) Preferably, write the answers in sequential order.

Marks

1. (A) Answer any SIX :

12

- Define Holding Current and Latching Current for SCR.
- List four regions in characteristics of power transistor.
- Draw two transistor equivalent circuit of SCR & label it.
- Define : (1) Chopper (2) Inverter
- Define commutation. What is meaning of natural commutation ?
- List two applications of choppers.
- State advantages of controlled rectifier over uncontrolled rectifier.
- What is function of timer ?

(B) Answer any TWO :

08

- Explain how DC voltage is varied in single phase half wave controlled rectifier with resistive load.
- Give classification of choppers on the basis of input, output voltage levels and directions of output voltage current.
- It is desirable in a LDR based application in industry to change intensity of light falling on it. Suggest a electronic circuit and explain its working with appropriate circuit diagram.

P.T.O.

2. Answer any FOUR :**16**

- (a) Draw single phase controlled bridge rectifier with R-L load and explain its working. Draw i/p, o/p voltage & current waveforms.
- (b) Explain operation of step-down chopper with waveforms for output voltage and current.
- (c) Compare ON line and OFF line UPS w.r.t. following points :
 - (1) Nature of output
 - (2) Transfer time
 - (3) Condition of mains static switch
 - (4) Condition of UPS static switch
- (d) Draw symbol of TRIAC. It can be operated in how many mode ? Which mode is most sensitive ?
- (e) Explain operation of class-C commutation with neat sketch and o/p load voltage & current waveforms.
- (f) Draw circuit diagram of step-up chopper. Explain its working with i/p & o/p voltage waveforms.

3. Answer any FOUR :**16**

- (a) Draw symbol and characteristics of DIAC, SUS.
- (b) Draw circuit diagram of three phase half wave controlled rectifier circuit with o/p voltage waveform.
- (c) Draw symbol of SCR. Draw its Static V-I characteristics. Name various regions on it.
- (d) Using UJT relaxation oscillator circuit how SCR can be fired ? Draw circuit & o/p pulses, capacitor voltage waveform.
- (e) Draw half-wave controlled rectifier (R-L) load with free-wheeling diode. Explain the effect of freewheeling diode on the circuit with o/p voltage waveform.
- (f) Sketch circuit of three phase uncontrolled half wave rectifier (Resistive load). Draw its i/p and output waveforms.

4. Answer any FOUR :**16**

- (a) What is need of Inverter ? List four applications of Inverters.
- (b) Explain constructional details of PUT. Why it is called programmable ?
- (c) With help of appropriate circuit diagram explain working of battery charging regulator.
- (d) Compare linear regulator with S.M.P.S. on the basis of
 - (1) Efficiency
 - (2) Power dissipation
 - (3) Ripple
 - (4) Heat sink
- (e) It is required to fire SCR from 0 to π in sinusoidal input. Suggest a firing circuit. Explain it with neat circuit diagram.
- (f) Draw circuit diagram of single phase half bridge inverter. Explain its working with o/p voltage waveform.

5. Answer any FOUR :**16**

- (a) With the help of block diagram explain principle of ON LINE UPS.
- (b) Draw symbol of SCS. Draw its constructional details. How SCS is turned ON and turned OFF ?
- (c) Explain working of centre tapped full wave controlled rectifier (R load) with neat circuit diagram & i/p-o/p voltage & current waveforms.
- (d) With neat circuit diagram, explain how pulse transformer is used for firing SCR.
- (e) Draw constructional diagram of n-channel IGBT. Draw its symbol. List its applications.
- (f) Compare three phase uncontrolled and controlled rectifier (Resistive load) (any four points).

6. Answer any FOUR :

- (a) Write function of :
- (1) Switching element
 - (2) Catch diode
 - (3) L-C filter
 - (4) Comparator in S.M.P.S.
- (b) A single phase half wave rectifier is used to supply power to load impedance 10Ω from 230 V 50 Hz A.C. supply at firing angle 30° . Calculate average load voltage.
- (c) Compare natural and forced commutation w.r.t. need of external commutating components, types of supply, cost of commutation circuit, power dissipation.
- (d) Define following parameters for G.T.O.
- (1) maximum gate to cathode reverse voltage
 - (2) maximum controllable anode current.
- (e) List four applications of power MOSFET. Why thermal run away does not take place in power MOSFET ?
- (f) Draw the circuit of class A commutation for SCR & describe its operation.
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17444

15116

3 Hours / 100 Marks

Seat No.

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- Instructions* – (1) All Questions are *Compulsory*.
- (2) Illustrate your answers with neat sketches wherever necessary.
- (3) Figures to the right indicate full marks.
- (4) Assume suitable data, if necessary.
- (5) Use of Non-programmable Electronic Pocket Calculator is permissible.
- (6) Preferably write the answers in sequential order.

Marks

1. a) Attempt any SIX of the following :

12

- (i) Draw the symbols of –
- (1) SUS
- (2) LASCR
- (ii) State any two uses of IGBT.
- (iii) Name any two triggering devices used triggering triac.
- (iv) Define inverter and state its any two applications.
- (v) State difference between forced commutation and natural commutation. (Any two points)
- (vi) Define choppers and classify it.
- (vii) Give classification of controlled rectifiers.
- (viii) State any two applications of UPS.

P.T.O.

b) **Attempt any TWO of the following :****8**

- (i) Compare half wave controlled rectifier and full wave controlled rectifier with respect to following parameters.
 - (1) Number of SCR's
 - (2) Average load voltage
 - (3) Ripple frequency
 - (4) Applications
- (ii) Compare between step-down and step-up chopper.
(Any four points)
- (iii) Draw the labelled circuit diagram of DC delay timer using SCR and UJT.

2. Attempt any FOUR of the following :**16**

- a) Draw V-I characteristics of SCR and define –
 - (i) Holding current
 - (ii) Latching current
- b) Describe RC gate triggering method of SCR with neat circuit diagram and waveforms.
- c) Draw block diagram of SMPS and describe its working.
- d) Draw circuit diagram of step-down chopper and explain its working with neat waveforms.
- e) Draw the circuit diagram of single phase half bridge inverter. Explain its working with neat waveforms.
- f) Draw the circuit diagram and input and output voltage waveforms of 3-phase half wave rectifier with resistive load.

3. Attempt any FOUR of the following :**16**

- a) Draw structure of a power MOSFET. State any two applications of it.
- b) Differentiate SCR and TRIAC with respect to –
 - (i) Symbol
 - (ii) Layered diagram
 - (iii) Operating quadrant
 - (iv) Application
- c) Draw two transistor analogy circuit of SCR. Write equation for I_D and describe its working.
- d) Draw single phase centre tapped controlled rectifier with RL load and its load voltage waveform.
- e) Draw the neat circuit diagram of single phase half wave controlled rectifier with resistive load and describe its working.
- f) A single phase full wave controlled rectifier is supplied with a voltage $V = 200 \sin(314t)$. Find average output DC voltage and current if firing angle is 30° and load resistance is 100Ω .

4. Attempt any FOUR of the following :**16**

- a) Draw the neat circuit diagram of step-up chopper and draw its input and output voltage waveforms.
- b) Draw constructional diagram of GTO and state two differences between GTO and SCR.
- c) Draw fan speed regulator circuit using DIAC and TRIAC.
- d) Draw circuit diagram of class C commutation and explain its working.
- e) Draw circuit diagram of simple battery charger and explain its working.
- f) Define harmonic factor and total harmonic distortion with respect to inverters.

- 5. Attempt any FOUR of the following :** **16**
- a) Draw the neat circuit diagram of emergency lighting system using SCR and describe its working.
 - b) What is polyphase rectifier ? State its advantages.
 - c) Draw V-I characteristics of UJT and describe its different operating regions.
 - d) Draw the circuit of synchronised UJT gate triggering of SCR and explain its working.
 - e) Draw the labelled constructional diagram of NPN bipolar power transistor. State function of various layers.
 - f) Draw the circuit of 3-phase half wave controlled rectifier and draw its input and output voltage waveforms.
- 6. Attempt any FOUR of the following :** **16**
- a) Describe the working of DC flasher circuit using SCR with neat diagram.
 - b) Draw the circuit of single phase bridge controlled rectifier and explain its working with neat waveforms.
 - c) Draw circuit diagram of class-B commutation of SCR and describe its working.
 - d) Draw constructional diagram of LASCR and describe its working principle.
 - e) Draw V-I characteristics power transistor. What is primary and secondary breakdown ?
 - f) List various commutation methods of SCR and draw class D commutation circuit.
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3 Hours / 100 Marks

Seat No.

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- Instructions :**
- (1) All Questions are *compulsory*.
 - (2) Answer each next main Question on a new page.
 - (3) Illustrate your answers with neat sketches wherever necessary.
 - (4) Figures to the right indicate full marks.
 - (5) Use of Non-programmable Electronic Pocket Calculator is permissible.

Marks

1. (A) Attempt any SIX :

2 × 6 = 12

- (a) Name any two triggering devices used for SCR.
- (b) List two features of IGBT.
- (c) Define (i) Latching current and (ii) Holding current.
- (d) List two applications of chopper.
- (e) Define commutation. What is the meaning of natural commutation ?
- (f) State the concept of chopper.
- (g) Define firing angle and conduction angle.
- (h) State any two applications of UPS.

(B) Attempt any TWO :

4 × 2 = 08

- (a) Compare controlled and uncontrolled rectifier (any four points).
- (b) Define inverter and give classification of inverter.
- (c) Draw the labelled circuit diagram of Electronic Timer using SCR.

2. Attempt any FOUR :

4 × 4 = 16

- (a) Draw the circuit diagram and input and output voltage waveforms of 3 ϕ half wave rectifier with resistive load.
- (b) Draw the circuit diagram of step-up chopper and state its operating principle.

P.T.O.

- (c) State the working of temperature controller circuit using SCR with neat diagram.
- (d) State the advantages and applications of GTO.
- (e) Describe the working of Class-B commutation with neat circuit diagram.
- (f) State different performance parameters of inverter and describe any two in details.

3. Attempt any FOUR :**4 × 4 = 16**

- (a) Draw V-I characteristics of DIAC. Is DIAC equally sensitive in both the directions ? Give two applications of DIAC.
- (b) Draw and explain single phase half wave controlled rectifier circuit with RL load.
- (c) Draw the two transistor model of SCR and explain it.
- (d) Compare power BJT, power MOSFET and IGBT (any four points).
- (e) Describe the effect of free wheeling diode in controlled rectifiers.
- (f) Draw the single phase full wave bridge type controlled rectifier. Draw the waveforms of input voltage, load voltage and voltage across SCR.

4. Attempt any FOUR :**4 × 4 = 16**

- (a) Define the following terms w.r.t. inverters :
 - (i) Harmonic factor of n^{th} harmonic
 - (ii) Total harmonic distortion
 - (iii) Distortion factor
 - (iv) Lowest order harmonics.
- (b) What is SMPS ? State types of SMPS. Sketch block diagram of SMPS and label it will.
- (c) Describe LASCOR. Give its industrial applications.
- (d) List various forced commutation methods. Explain self commutation by resonating load.
- (e) With neat sketch, explain SCR based battery charger circuit. Which component avoid overcharging ?
- (f) State different advantages of MOSFET inverter.

5. Attempt any FOUR :**4 × 4 = 16**

- (a) Draw the neat circuit diagram of emergency lighting system using SCR and describe its working.
- (b) Draw V-I characteristics of PUT and describe the role of its operating regions.
- (c) What is the poly phase rectifier ? State its need.
- (d) Describe the operation of pulse transformer used in triggering circuits.
- (e) Draw labelled layer diagram of N-Channel IGBT. Draw its V-I characteristics.
- (f) Differentiate between single phase controlled half wave rectifier and single phase controlled full wave rectifier.

6. Attempt any FOUR :**4 × 4 = 16**

- (a) Sketch circuit diagram of low power DC flasher and state how flashing occurs.
 - (b) A single phase half wave rectifier is used to supply power to load impedance 10Ω from 230 V, 50 Hz A.C. supply at firing angle 30° . Calculate average load voltage.
 - (c) Compare natural and forced commutation.
 - (d) State one application each for
 - (i) SCR
 - (ii) PUT
 - (iii) TRIAC and
 - (iv) GTO
 - (e) Explain dv/dt turn on method of an SCR.
 - (f) State any two features of power MOSFET. Which makes it suitable for medium power applications ?
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