

# 17638

**15162**

**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 THREE of the following: 12
- (i) Draw construction of SCR using two transistor models. Explain its operation.
- (ii) State the necessity of converter and give the classification of controlled converter.
- (iii) List drawbacks of harmonics at the output of inverter. Explain PWM method of harmonic reduction.
- (iv) Describe the working of full converter and drives for speed control of DC series motor.
- b) Attempt any ONE of the following: 6
- (i) Draw and explain the three phase full converter thyristor bridge for resistive load. For this converter, do the following:
- 1) Sketch waveforms for three phase input voltage  $v_{ab}$ ,  $v_{ac}$ ,  $v_{bc}$ ,  $v_{ba}$  etc.

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2) From (1) sketch waveforms of the output voltage  $v_o$  for a firing angle of zero degree and overlap angle is  $30^\circ$ . Indicate the conduction of various SCRs.

(ii) Describe the operation of parallel inverter and state its advantages.

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

- a) State different SCR triggering methods. Explain  $dv/dt$  triggering methods.
- b) State the effect of source inductance on the performance of single phase fully controlled converter indicating clearly the conduction of various thyristors during one cycle.
- c) Draw circuit for single phase full wave converter with R-L load and draw its load voltage and current-waveform.
- d) Explain principle of step up chopper with neat circuit diagram. Derive the expression of output voltage.
- e) Write comparisons of type A and type B choppers.
- f) Describe with neat circuit diagram of battery charging using SCR.

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

- a) Draw symbol and characteristics of GTO, SUS, LASCR, IGBT power semiconductor and its important information and application.
- b) Draw and explain the circuit diagram and waveform of full wave control bridge converter with resistive load.
- c) Explain the SCR turnoff process with waveforms of voltage and current.
- d) Describe the principle of DC chopper operation. Derive an expression for its average output voltage.
- e) Draw and explain the speed control of a DC series motor with single phase step down chopper.

4. a) Attempt any THREE of the following: 12

- (i) With the circuit diagram and waveform, explain the working of Jones chopper.
- (ii) Explain the selection factors of SCR and its testing.
- (iii) Describe the working of resistance welding method with diagram.
- (iv) Sketch output voltage, output current, source current and thyristor current waveform for type-C chopper. Indicate the conduction of various devices.

b) Attempt any ONE of the following: 6

- (i) Discuss the method of overcoming the intermittent power flow in a basic series inverter. Illustrate your answer with relevant circuit and waveform.
- (ii) For a single phase fully controlled half wave converter system, and sketch waveforms for load voltage and load current for
  - 1) RL load and
  - 2) RL load with free wheeling diode across RL.

From a comparison of these waveforms, discuss the advantages of using a free wheeling diode.

- 5. Attempt any FOUR of the following:** **16**
- a) Draw the circuit diagram and explain the variable frequency control of induction motor.
  - b) Draw and explain single phase cycloconverter.
  - c) Draw the circuit diagram of a single phase SCR full bridge inverter. Explain how power can flow either direction in this circuit.
  - d) Draw the circuit diagram and explain DC static circuit breaker.
  - e) Draw and explain the three phase series inverter.
  - f) Describe briefly and compare the various methods employed for the control of output voltage of inverter.
- 6. Attempt any FOUR of the following:** **16**
- a) Discuss the working of a load-commutated chopper with relevant voltage and current waveforms. Show voltage variation across each pair of SCRs as a function of time.
  - b) Describe with circuit diagram the working of static VAR compensator.
  - c) Describe the working of close loop speed control method for AC servomotor and DC servomotor.
  - d) State the principle of induction heating. Draw the block diagram of it using thyristor circuit.
  - e) Define the following terms relating to SCR and discuss their significance.
    - (i) forward break over voltage.
    - (ii) on-state voltage drop
    - (iii) Latching current
    - (iv) Holding current
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