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Question Paper Code: 41654

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2017

Fifth Semester

Instrumentation and Control Engineering

14UIC504 – POWER ELECTRONICS AND APPLICATIONS

(Regulation 2014)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. As Compared to power MOSFET, a BJT has
 - (a) Lower Switching losses but higher conduction loss
 - (b) Higher Switching losses and higher conduction loss
 - (c) Higher Switching losses but lower conduction loss
 - (d) Lower Switching losses and lower conduction loss
2. The Semiconductor device which is suitable for induction hardening in radio frequency range is
 - (a) MCT
 - (b) BJT
 - (c) IGBT
 - (d) MOSFET
3. Reactive loading of supply lines by a converter is directly dependent on
 - (e) Displacement angle only
 - (f) Displacement angle and distortion factor
 - (g) Back emf in the load circuit
 - (h) Circuit configuration

4. A Converter which can operate in both 3-pulse and 6-pulse modes is a
- (a) 1-phase full converter
 - (b) 3-phase half-wave converter
 - (c) 3-phase semi converter
 - (d) 3-phase full converter
5. A Chopper can be used on
- (a) Pulse – Width modulation only
 - (b) Frequency modulation only
 - (c) Amplitude modulation only
 - (d) Both PWM and FM
6. A step – up chopper has V_s as the source voltage and α as the duty cycle. The output voltage for this chopper is given by
- (a) $V_s (1 + \alpha)$
 - (b) $V_s / (1 - \alpha)$
 - (c) $V_s (1 - \alpha)$
 - (d) $V_s / (1 + \alpha)$
7. In Single – Pulse modulation of PWM inverters, third harmonic can be eliminated if pulse width is equal to
- (a) 30°
 - (b) 60°
 - (c) 120°
 - (d) 150°
8. A Single phase CSI has capacitor C as the load. For a constant source current, the voltage across the capacitor is

- (a) Square Wave
- (b) Triangular Wave
- (c) Step Function
- (d) Pulsed Wave

9. In a single – Phase voltage controller with RL load, ac output power can be controlled if
- (a) Firing angle $\alpha > \phi$ (load Phase angle)and conduction angle $\gamma < \pi$
 - (b) $\alpha > \phi$ and $\gamma < \pi$
 - (c) $\alpha < \phi$ and $\gamma = \pi$
 - (d) $\alpha < \phi$ and $\gamma > \pi$
10. The Cyclo converters (CCs) require natural or forced commutation as under:
- (a) Natural Commutation in both step – up and Step – down CCs.
 - (b) Forced Commutation in both step – up and Step – down CCs.
 - (c) Forced Commutation in both step – up CCs.
 - (d) Forced Commutation in both step – down CCs.

PART - B (5 x 2 = 10 Marks)

- 11. What is a Snubber Circuit?
- 12. What are the advantages of six-pulse converter?
- 13. What is meant by step-up and step-down chopper?
- 14. What are the applications of an inverter?
- 15. What is meant by Cyclo-converter and its types?

PART - C (5 x 16 = 80 Marks)

16. (a) Explain the constructions and switches characteristics of power MOSFET. (16)

Or

- (b) (i) Describe the working of an IGBT. How does latch – up occur in an IGBT? (12)
- (ii) Give a comparison between an IGBT and a PMOSFET (4)

17. (a) Describe the working of single phase fully controlled bridge converter in the rectifying mode and inversion mode. Also sketch the following waveforms for delay angle α load voltage, load current and thyristor voltage (16)

Or

- (b) Explain the operation of dual converter with a neat circuit diagram. (16)

18. (a) Explain the current limit control and time ration control as applied to dc chopper (16)

Or

- (b) Discuss the operation of DC – DC Buck Boost converter with its waveform and derive the peak to peak ripple induction current and capacitor voltage (16)

19. (a) Discuss the principle of working of a three – phase bridge inverter with an appropriate circuit diagram. Draw phase and line voltage waveforms on the assumption that each thyristor conducts for 180° and the resistive load is star connected. The sequence of firing of various SCRs should also be indicated in the diagram. (16)

Or

- (b) Describe a single phase CSI connected to load R with the help of its power circuit diagram and waveforms for gating signals, load current, capacitor voltage and current, input voltage and voltage across one thyristor. (16)

20. (a) Describe the working of a multistage sequence control of voltage controllers. (16)

Or

- (b) Describe the operating principle of single – phase to single phase step – up cyclo converter with the help of mid-point and bridge type configurations. Illustrate your answer with appropriate circuit and waveforms. The conduction of various thyristors must also be indicated on the waveforms. (16)