Register Number.....

B.E DEGREE EXAMINATIONS: APRIL / MAY 2009

Third Semester

MECHATRONICS ENGINEERING

U07MH304 Power Electronics

Time: Three hours **Maximum Marks: 100**

Answer ALL the Questions:-

PART A (20 x 1 = 20 Marks)

1. Silicon controlled rectifier was introduced first in

   (a) 1958 (b) 1957 (c) 1914 (d) 1988

2. Power electronics converters are

   (a) Phase controlled rectifier (b) DC chopper

   (c) Inverters (d) all the above

3. The value of the R and C in snubber circuit is

   (a)$R=2\sigma\sqrt{L/C}$ & $C=(2\sigma/R_s)^2L$ (b)$C=(R_s/2\sigma)^2$ & $R=2\sqrt{L/C}$

   (c) $R=\sigma\sqrt{L/C}$ & $C=(2\sigma/R_s)^2L$ (d)none of these

4. The function of snubber circuit connected across SCR is to

   (a) Suppress dv/dt (b) increase dv/dt

   (c) Decrease dv/dt (d) keeps the transient voltage at a constant value

5. A freewheeling diode is also called as

   (a) By-pass diode (b) commutating diode

   (c)(a) & (b) (d) none of these

6. Commutation angle is denoted as

   (a) α (b)β (c) μ (d)ξ

7. The effect of the source inductance is to provide

   (a) Load current constant (b) load voltage constant

   (c) Source current constant (d) source voltage constant

8. The average output voltage of single phase full bridge converter is given by

   (a)$V_o=V_m/\pi[\cos\alpha+\cos(\alpha+\mu)$ (b)$V_o=2V_m/\pi(\cos\alpha)$

   (c)$Vo=V_m \sin\omega t$ (d)$V_0=V_m \cos(\alpha+\mu)$

9. In DC choppers, if T_{on} is the on period and f is the chopping frequency, then output voltage in terms of input voltage V_s is given by

(a) Vs.Ton/f (b)Vs.f/Ton (c)Vs/F.Ton (d)Vs.f.Ton

10. For a step up chopper with R load, the rms value of output voltage

(a) $\sqrt{\alpha}$.Vs (b) $\sqrt{\alpha}$.Vs/R (c)R/ α (d) none of these

11. In DC choppers, if T is the chopping period, then output voltage can be controlled by PWM by varying

(a)T keeping T_{on} constant (b) T_{on} keeping T constant

(c)T_{off} Keeping T constant (d) T keeping T_{off} constant

12. Duty cycle is given by

(a) α =Ton/T (b) α =T (c) α =Ton.T (d) α = f.Ton

13. For a 3 phase bridge inverter in 180 conduction mode. The sequence of SCR conduction in the first two steps ,beginning with the initiation of thyristor 1,is

(a)6,1,2 and 2,3,1 (b)2,3,1 and 3,4,5

(c)3,4,5 and 5,6,1 (d)5,6,1 and 6,1,2

14. In single pulse modulation of PWM inverters, third harmonic can be eliminated if pulse width is equal to

(a) 30^0 (b) 60^0 (c) 120^0 (d)150^0

15. A single phase full bridge inverter can operate in load commutation mode in case load consists of

(a)RL (b) RLC under damped

(c)RLC over damped (d) RLC critically damped

16. A single phase full bridge VSI has inductor L as the load for a constant source voltage, the current through the inductor is

(a) Square wave (b) triangular wave (c) Sine wave (d) pulsed wave

17. AC voltage controller is adapted for

(a) Open loop control system (b) close loop control system

(c) Both open and closed (d) none of these

18. The number of thyristors required for single phase to single phase cycloconverter of the mid point type and for three phase to three phase 3 pulse type cycloconverter are

(a) 4, 6 (b) 8, 18 (c) 4, 18 (d) 4, 36

19. For converting 3 phase supply at one frequency to single phase supply at a lower frequency, the basic principle is to _____(1.vary / 2.keep) the firing angle _____(3.constant / 4.gradually).

(a)1 & 3 (b)1 & 4 (c)2 & 3 (d)2 & 4

20. Application of cycloconverter

(a) Speed control of high power drives (b) Induction heating

(c) Static VAR generation (d) All the above

PARTB (5 x 16 = 80 Marks)

21.(a)(i) Explain the principle of operation of IGBT. (8)

(ii) Draw and explain the switching characteristics of SCR? (8)

(OR)

(b)(i) Describe in detail the various protection circuits required for thyristors. (8)

(ii)Draw and explain the two transistor model of a SCR. (8)

22.(a)With an aid of neat diagram and waveform explain the effect of source inductance in single phase full converter. Derive the expression for the average output voltage.

(OR)

(b)(i)Explain briefly the power factor improvement technique for the converters. (8)

(ii)Explain any two types of thyristor triggering circuits with neat diagram. (8)

23.(a)(i)Explain the types of choppers in detail with neat diagram. (8)

(ii)What are the different control strategies employed in chopper. Explain them in detail. (8)

(OR)

(b)(i)Draw the voltage commutated chopper circuit and explain. (8)

(ii)Derive steady state time domain analysis of type A chopper. (8)

24.(a)Explain the working of single phase full bridge inverter circuit for R,RL and RLC loads. Draw the output voltage and current waveforms for all types of loads.

(OR)

(b)Explain the types of voltage control in single phase inverter with neat diagram.

25.(a)(i) Draw and explain the single phase AC voltage regulator with R load. (8)

(ii)With the circuit and waveforms explain how the single phase voltage is synthesized from 3 phase supply. (8)

(OR)

(b) (i) Draw the power circuit of a 1Φ to1Φ step down cycloconverter. Explain its operation with output voltage and current waveforms. Assume load is continuous.

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