Subject Name: MODERN POWER ELECTRONICS

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Year and Sem, Department: IV-EEE SEM-I

Unit-I:
High-Power Semiconductor Devices:

Important points / Definitions: (Minimum 15 to 20 points covering complete topics in that unit)

Short Questions (minimum 10 previous JNTUH Questions – Year to be mentioned)

Short questions:
Unit -1:
1.What is a bipolar transistor (BJT)? What are the types of BJTS?
2.What are the input and output characteristics of NPN-transistor?
3.What are the three regions of operation for BJTS?
4.What is a trasductance of BJTS?
5.What is the cause of delay time in BJTS?
6.What is a saturation mode of BJTS?
7.What is FBSOA and RBSOA of BJTS?
8.What are the advantages and disadvantages of BJTS?
9.What are the difference between enhancement type MOSFET and depletion type MOSFET?
10.What is a threshold voltage of MOSFET?
11.Why do the MOSFETs not require negative gate voltage during turn offs?
12.What are the transfer characteristics of IGBTs?
13.What is a SIT? What are the advantages of SITS?
14.What are the main difference between MOSFETs and BJTS?
15.What are the problems of parallel operation of BJTS and MOSFETs?
16.What are the problems of series operation of BJTS and MOSFETs?
17.What is the purpose of shunt snubber in transistor?
18.What is the V-I characteristics of thyristor?
19.What is on and Off state condition of thyristor?
20.What is the latching current of thyristor?
21.What is a holding current of thyristor ?
22.What is the difference between AC SCR and a TRIAC?
23.What are the advantages and disadvantages of LASCRS?
24.What are the advantages and disadvantages of SITHs?

25.What are the advantages and disadvantages of GTOS?
26.What is a snubber network?
27.What are the advantages and disadvantages of MTOs and ETOs?
28.What is the common technique for current sharing of parallel connected thyristor?
29.What is a derating factor series connected thyristor?

Long Questions (minimum 10 previous JNTUH Questions – Year to be mentioned)

1Derive an expression relating speed and torque of a single phase full converter fed separately excited DC motor drive operating in the continuous current mode
2Describe the operation of single phase fully controlled rectifier control of DC series motor and obtain the expression for motor speed for continuous mode of operation
3Describe the operation of single phase semi controlled rectifier control of DC series motor and obtain the expression for motor speed for continuous mode of operation
4Describe the operation of single phase Semi controlled rectifier control of DC separately excited motor and obtain the expression for motor speed for continuous mode of operation
5Explain the use of freewheeling diode in the converter fed DC drives. Take an example of 1-phase fully controlled converter fed for explanation. How it is going to affect the machine performance.
6What are the advantages of three phase drives over single phase drives
7Explain the motoring and braking operation of three phase fully controlled rectifier control of dc separately excited motor with aid of diagrams and waveforms. Also obtain the expression for motor terminal voltage speed.
8Explain the operation of three phase full controlled rectifier fed dc series motor drives with waveforms and characteristics
9Explain the operation of three phase half controlled rectifier fed dc series motor drives with waveforms and characteristics
10Explain the operation of three phase half controlled rectifier fed dc separately excited DC motor drives with waveforms and characteristics
11Derive an expression for an average output voltage of a 1-phase semi-converter. Assuming a very highly inductive load, draw the waveforms of output voltage, load current and voltage across thyristors
12Compare three phase drives and single phase drives
13A single phase fully controlled thyristor converter is supplying a DC separately excited DC motor. Draw the neat waveforms diagrams and explain various operating modes of the drive Both in motoring and regenerative braking for
$\gamma < \alpha$
$\gamma < \alpha$
Where α is the firing angle, γ is the angle at which the source voltage equal to the motor back emf. Assume the armature of the separately excited dc motor

UNIT-1

1. An SCR can be operated in[ ]
a) Only on reverse bias condition b) Only on forward biased condition
c) Both forward bias and reverse bias d) Without forward bias

2. A thyristor can be termed as [ ]
a) Dc switch b) AC switch c) Both AC and DC switch d) Square wave switch

3. When anode positive with respective to cathode in an SCR the number of blocked pn junctions
a) 1 b) 2 c) 3 d) 4 [ ]

4.In a thyristor anode current is made of [ ]
a) Electronics only b) Electronics or holes
c) Electronics and holes d) Electronics, holes, protons

5.The number of p-n junction in a thyristor are/is [ ]
a) 1 b) 2 c) 3 d) 4

6.An SCR is a [ ]
a) Two layer two junction device b)Three layer two junction
c) Four layer three junction device d) Four layer four junction device

7.When cathode is positive with respective to anode in an number of blocked pn junctions
a) 1 b) 2 c) 3 d) 4

8.An SCR has [ ]
a)One terminal b)Two terminal c)Three terminal d)Four terminal

9.Choose the correct statement[ ]
a)Both MOSFET and BJT are voltage controlled devices
b)Both MOSFET and BJT are current controlled devices
c)MOSFET is a voltage controlled devices where as BJT is a current controlled device
d)MOSFET is current controlled devices and BJT are voltage controlled devices

10. As compared to power MOSFET, a BJT has [ ]
a) Lower switching losser but higher conduction loss
b) Higher switching losser but higher conduction loss
c) Higher switching losser but lower conduction loss
d) lower switching losser but lower conduction loss

11.Power MOSFET has three terminals called[ ]
a) Collector, emitter, and base b) Drain, source and base
c) Drain , source and gate d) Collector, emitter and gate

12.An IGBT has three terminals called [ ]
a) Collector, emitter, and base b) Drain, source and base
c) Drain , source and gate d) Collector, emitter and gate

13. A thyristor, when triggered, will change from forward blocking state to conduction state if
its anode to cathode voltage is equal to [ ]
a) Peak repetitive off state forward voltage b) Peak working off state forward voltage
c) Peak working off state reverse voltage d) Peak non repetitive off state forward voltage

14. When a thyristor gets turned on, gate drive [ ]
a) Should be removed
b) Should be removed in order to avoid increased losses and higher junction temperature
c) May or may not be removed
d) Should not be removed as it will turn off the SCR

15. Once SCR start conducting a forward current, its gate losses control over [ ]
a) Anode circuit voltage only b) Anode circuit current only
c) Anode circuit voltage and current d) Anode circuit current

16.An SCR can be brought to forward conducting state with gate circuit open when the applied voltage exceeds [ ]
a) 1.5v b) Reverse breakdown voltage
c) Forward breakdown voltage d) Peak non repetitive off state voltage

17. In a thyristor, holding current is [ ]
a) More than latching I_L Less than latching I_L
c) Equal to I_L Very small

18. During forward blocking state, a thyristor is associated with [ ]
a) Large current, low voltage b) Low current, large voltage
c) Medium current, large voltage d) High current, high voltage

19. Ratio of latching current to holding current of thyristor is generally of the order of
a) Two to three times b) Four to five times [ ]
c) Seven to eight times d) Ten to twelve times

20. Turn on time of an SCR can be reduced by using a [ ]
a) Rectangular pulse of high amplitude and narrow width
b) Rectangular pulse of low amplitude and wide width
c) Triangular pulse
d) Sinusoidal pulse

KEY: 1-B, 2-A, 3-A, 4-C, 5-C, 6-C, 7-B, 8-C, 9-C, 10-C, 11-C, 12-D, 13-B, 14-B, 15-C, 16-C, 17-B, 18-A, 19-A, 20- A

1. The function of connecting a zener diode in an UJT circuit, used for the triggering of SCR's

is to

a) Expedite the generation of triggering pulses[ ]
b) Delay the generation of triggering pulses
c) Provide a constant voltage to UJT to prevent erratic firing.
d) Provide a variable voltage to UJT on the source voltage change.

2. The maximum firing angle that can be obtained from R-triggering [ ]
a) 00 b) 450 c) 300 d) 900

3. Using R-C triggering maximum firing angle that can be obtained practically [ ]
a) 1700b) 900 c) 450 d) 00

4. R-C- triggering is preferred over R triggering method because it provides[ ]
a) Larger value of firing angles b) Quick firing
c) Accurate firing d) Large pulses

5. A pulse is used to trigger a thyristor because [ ]
a) Reduce harmonics b) Increases thyristor loss
c) Reduces thyristor loss d) Reduces harmonics and increases thyristor loss

6. For an UJT employed for triggering of an SCR, standoff ratio and dc source of η-0.64 voltage V is 30V. The UJT would trigger when emitter voltage is [ ]
a) 10 b) 12.8 c) 19.2 d)5V

7. Pulse gate triggering is achieved by [ ]
a) Rheostatic method b) R-C method
c) UJT relaxation oscillator d) R, r-C triggering methods

8. Intrinsic standoff ratio of a UJT is given [ ]
a) RB1+RB2 b) RB1/ RB2 c) RB1/ RB1+RB2 d) RB1-RB2

9. In an UJT, with V the voltage across two base terminals, the emitter potential at peak point is given by
a) nV_{BB} V_D $V_{D+}V_{BB}$ V_D+nV_{BB}

10. An UJT exhibits negative resistance region [ ]
a) Before the peak point b) Between peak and valley point
c) After the valley point d) Before the valley point

11. SCRs with a rating of 1000V and 200V are available to be used in a string to handle 6KV and 1KV No. of serried connected SCRS, incase derating factor is 0.1 [ ]
a) 4 b)5 c) 6 d) 7

12. The di/dt rating of an SCR is specified for its [ ]
a) Decaying anode current b) Decaying gate current
c) Rising gate current d) Rising anode current

13. The function of snubber circuit connected across gate circuit is to [ ]

a) Suppress dv/dt b) Increase dv/dt
c) Decrease dv/dt d) Keep transient over voltages at a constant value

14. The object of connecting resistance and capacitance across gate circuit is to protect the SCR gate against [ ]
a) over voltages b) Dv/dt c) Noise signals d) Over currents

15. For dynamic equalizing circuit used for serried connected SCR's the choice of C is based on
a) Reverse recovery characteristics b) Turn - on characteristics [ ]
c) Turn -off characteristics d) Rise-time characteristics

16. For an SCR dv/dt protection is achieved through the use of [ ]
a) R in series with SCR b) RC across SCR
c) L in series with SCR d) L across SCR

17. For an SCR, di/dt protection is achieved through the use of [ ]
a) R in serried with SCR b) RL in serried with SCR
c) L in serried with SCR d) L across SCR

18. Heat sinks are made from [ ]
a) Copper b) Steelc) Aluminium d) Copper and steel

19. Practical way of obtaining static voltage equalization in series connected SCRs is by[ ]
a) One register across the string b) Resistors of different values
c) Resistors of the same value across each SCR d) One resistor in series with the string.

20. If the string efficiency is 0.1 then the derating factor is [ ]
a) 0.1 b) 0.2 c) 0.8 d) 0.9

KEY: 1-C, 2-D, 3-A, 4-A, 5-C, 6-C, 7-C, 8-C, 9-D, 10-B, 11-D, 12-D, 13-A, 14-C, 15-A, 16-B, 17-C, 18-C, 19-C, 20-D

UNIT-II- Cascaded H-Bridge Multilevel Inverters

Unit-2:
1.What is an inverter? What is the principle of operation of an inverter?
2.What are the difference between half bridge and full bridge inverter?
3.What are the purpose of feedback diodes in inverter?
4.What is the purpose of overmoudulation?
5.What is the third harmonic PWM. What is 60'PWM?
6.What is space vector transformation and what is space vector switching?
7.What are the techniques for harmonics reduction?

8.What are the advantages and disadvantages of variable DC link inverters?
9.What is the basic principle of a boost inverter?
10.What are the difference between AC and DC filters?
11.What are DC voltage Gain and AC voltage gain of the boost inverter ?
12.What are the features of a multilevel converter?
13.What is a diode clamped multilevel inverter write advantages and disadvantages?
14.What is cascaded multilevel inverter. Write advantages and disadvantages?
15.What is a back to back intertie system?
16.What are the possible application of multilevel inverter?

Objective questions:

1. A. Single phase half-wave rectifier has 400Sin 314t as the input voltage and R as the load.
For a firing angle of 600 for the SCR, average output voltage is [
a) 400/p b) 200/p c) 300/p d) 250/p

2. In the following converter whose pure number is one [
a) 1-Ø Full wave converter b) 1- Ø Half controlled converter
c) 1- Ø Half wave converter d) 3- Ø Half wave converter

3. In a 1- Ø half wave converter with R load, it the conduction interval is 1500 then what is the
firing angle of the SCR [
a) 300 b) 1800 c) 600 d) 1500

4. In a 1- Ø half wave converter with R load, if the firing angle of the SCR is 300 the angle at
which SCR stops ;the conduction is [
a) 300 b) 1800 c) 600 d) 1500

5. The pulse number of single phase half wave converter is [
a) 2 b) 4 c) 3 d) 1

6. In 1- Ø half wave converter with R load, if the firing angle of SCR is 300 what is the
conduction interval of thyristor is [
a) 300 b) 600 c) 1500 d) 1800

7. A 1- Ø half wave converter gives ------ mode of operation with resistive load [ ]
a) Continuous b) Discontinuous
c) Continuous and discontinuous d) For certain firing angles only continuous

8. In the following converter which one has internal free wheeling action [
a) 1- Ø half wave with R load b) 1- Ø full wave with bridge
configuration

c) 1- Ø full wave with midpoint configuration converter
d) 1- Ø half controlled

9. Effect of free wheeling diode [
a) Input power factor decreases
b) Reactive power consumption increases
c) Current waveform becomes discontinuous
d) Input power factor increases

10. Using a free wheeling diode current wave form becomes [
a) More continuous
b) More discontinuous
c) Sometimes continuous and discontinuous
d) No effect

11. In a 1- Ø half wave converter with R-L load and extinction angle is 2100 and firing angle is 300. What is the conduction angle of SCR [
a) 2100 b) 300 c) 180 d) Zero

12. What is the pure number of 1- Ø half wave converter with free wheeling diode [
a) 2 b) 1 c) 3 d) Zero

13. In a single phase half controlled converter with R-load and firing angle is 600. Each diode conducts for
a) 1200 b) 1500 c) 1800 d) zero [

14. In a single phase half controlled converter with R-load and firing angle is 600. conducts interval of freewheeling diode is [
a) α b) $\alpha-\beta$ c) $\pi-\alpha$ d) zero

15. In a single phase half controlled converter with R-load for a firing angle of 300. The conduction angle of scr is [
a) 300 b)1500 c) 1800 d) Zero

16. In a single phase half controlled converter with R load the output current wave form is
a) Continuous
b) Discontinuous [
c) Continuous and also Discontinuous
d) Continuous only for certain firing angles

17. A single phase semi converter input power factor is….to full converter [
a) High b) Low c) Same d) High or low

18. In any converter whether the waveform is continuous or discontinuous depends on [
a) Firing angle only
b) Extinction angle only
c) Time constant of load circuit
d) Firing angle, Extinction angle, Time constant of load circuit

19. A single phase semi converter with RL load. the current waveform can be [
a) Continuous
b) Discontinuous

c) Continuous and Discontinuous d) Can't be determined

KEY: 1-C, 2-C, 3-A, 4-B, 5-D, 6-C, 7-B, 8-D, 9-D, 10-A, 11-C, 12-B, 13-A, 14-D, 15-B, 16-B, 17-A, 18-D, 19-C

1. A single-phase two-pulse converter has an average output voltage and power output of 500v
and 10kw respectively. The tyristor used in the two-pulse bridge converter are now re-employed to form a single -phase two pulse midpoint converter. The new controlled converter would give, respectively an average output voltage and power output of [ ]
a.500v, 10kw b.250v, 5kw c.250v, 10kw d.500V, 5kw

2. A 1- Ø two pulse converter has an average output voltage and power output of 250V and
5kw respectively. The thyristor used in the two-pulse bridge converter are now-reemployed to form a single-phase two pulse midpoint converter. The new controlled converter would give respectively an average at output voltage and power output of
a.250V, 5kw b.125V, 2.5kw c.125v, 5kw d.500v, 5kw [ ]

3. A single-phase full wave mid-point thyristor converter used a 230/200v transformer with
centre tap on the secondary side. The PIV for each thyristor
a.100 b.141.4c.200 d.282.8[ ]

4. A Single-phase full wave mid-point thyristor converter uses400/200V transformer with centre tap on the secondary side. The PIV for each thyristor [ ]
a.100 b.141.4c.200 d.282

5. A single Phase full wave mid-point thyristor converter used 230/100v transformer with centre top on the secondary side. The PIV for each thyristor is [ ]
a.100 b.70.7 c.100 d.141.2

6. The secondary rms voltage of center tapped transformer used in midpoint configuration of
fully converter is $2V_s$. Then the PIV of each SCR is [ ]
a. 2Vs b. Vs/2 c. Vs d. 2Vs

7. The major advantage of fully controlled converter over semi converter is [ ]
a.Power factor improvement b.Internal freewheeling action
c.Single quadrant operation d.Two quadrant operation

8. Which one of the following converter can give both positive and negative average

voltages
a.1-φ full converter b.1-φ half wave converter [ ]
c.1-φ semi converter d.1-φ half wave and semi converter

9. No. of SCRs used in 1-φ full converter with midpoint configuration [ ]
a. 1 b. 2 c. 3 d. 4.

10. A 1-φ fully controlled converter is connected to a 200sin 314t voltage supply. Its output is fed to a load resistance of 10 and inductance 2H. The expression of transient current is
a. Ae^{-5t} b. Ae^{-t20} c. Ae^{-40t} d. Ae^{-3t} [ ]

11. In a single phase full converter with RL load, firing angle is 300 and its giving continuous mode of operation. The conduction angle of each SCR is [ ]
a. 300 b. 1500 c. 1800 d. 600

12. The input source frequency of fully controlled converter is F. the frequency of output of the converter is [ ]
a. F b. 2F c. 3F d. 4F

13. Which of the following converter can give regenerative operation [ ]
a. 1-φ half wave converter with R loadb. 1-φ fully controlled converter with RL load
c. 1-φ semi converter with R load d. 1-φ fully controlled converter with RLE load

14. In controlled rectifiers, the nature of load current [ ]
a. Does not depend on type of load and firing angle delay
b. Depends both on the type of load and firing angle delay
c. Depends only on the type of load d. Depends only on source voltage

15. A1-φ fully controlled converter can give [ ]
a. First quadrant of operation only b. Second quadrant of operation only
c. First and fourth quadrants d. All the four quadrants of operation

16. A 1-φ fully controlled converter needs (Bridge configuration) [
a. 2SCRs b. 4SCRs c. 1SCRs d. 5SCRs

17. Pulse number of a 1-φ fully controlled converter [ ]
a. 1 b. 2 c. 3 d. 4

18. How many full converters are needed to get all the quadrants of operation for the drive
a. 1 b. 2 c. 3 d. 4 [ ]

19. In a full converter with RL load SCR can conduct even during negative cycle of source voltage majority due to [ ]

a. Resistance b. Firing angle c. Inductance d. Resistance and inductance

20. A single phase full converter is operating with RL load. The average output voltage across the inductance is [ ]
a. V_S b. V/2 c. ZERO d. $2V_S$

KEY: 1-B, 2-B, 3-D, 4-D, 5-D, 6-D, 7-D, 8-A, 9-B, 10-A, 11-C, 12-B, 13-D, 14-B, 15-C, 16-B,
17-B, 18-B, 19-C, 20-D

1. Each diode of a 3-phase half-wave diode rectified conducts for [ ]
a. 60^0 b 12^0 c. 180^0 d. 90^0

2. Each diode of a 3-phase bridge diode rectified conducts for [ ]
a. 60^0 b. 12^0 c. 180^0 d. 90^0

3. In a 3-phase half-wave diode rectified, if per phase input voltage is 200 V, then the average
output voltage is [ ]
(a) 233.91V (b) 116.95 V (c) 202.56 V (d) 101.28V

4. In a 3-phase half-wave rectified, dc output voltage is 230 V. The peak inverse voltage across each diode is [ ]
a. 481.7 V b. 460V c. 345 V d. 230 V

5.. In a 3-phase full wave diode rectified, the peak inverse voltage in terms of average output
voltage is
a. 1.571 b. 0.955 c. 1.047 d. 2.094 [ ]

6. In a 3-phase half - wave diode rectified, if V_{mp} is the maximum value of per phase voltage,
then each diode is subjected to a peak inverse voltage of [ ]

a. V_{mp} b. c. $2V_{mp}$ d. $3V_{mp}$

7. In a 3-phase full-wave diode rectified, if V_{ml} is the maximum value of the line voltage, each
diode is subjected to a peak inverse voltage is [ ]

a. V_{ml} b. c. $2V_{ml}$ d. $3V_{ml}$

8. In a 3-phase full-wave diode rectifier , if V is the per phase input voltage, then average output voltage is given by [ ]
a. 0.955 V b. 1.35 V c. 2.34 V d. 3 V

9. 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.

10. In a 3-phase semi-converter, for firing angle less than or equal to 60^0, each thrystor and diode conduct, respectively, for [ ]
a. 60^0, 60^0 b. 90^0, 30^0 c 120^0, 120^0 d. 180^0, 180^0

11. In a 3-phase semi converter, for firing angle less than or equal to 60^0 freewheeling diode conducts for [ ]
a. 30^0 b. 60^0 90^0 d. zero degree

12. In a 3-phase semi converter, for a firing angle equal to 90^0 and for continuous conduction, each SCR and diode conduct respectively, for [ ]
a. 30^0, 60^0 b. 60^0 30^0 c. 90^0, 90^0 d. 30^0 30^0

13. In a 3-phase semi converter, for a firing angle equal to 90^0 and for continuous conduction, freewheeling diode conducts for [ ]
a. 30^0 b. 60^0 c. 90^0 d. Zero degree

14. In a 3 - phase semi converter, for firing angle equal to 120^0 and extinction angle equal to 110^0, each SCR and diode conduct, respectively, for [ ]
a. 30^0, 60^0 b. 60^0, 60^0 c. 90^0, 30^0 d. 11^0, 30^0

15. In a 3-phase semi converter, for firing angle equal to 120^0 and extinction angle equal to 110^0, free wheeling diode conducts for [ ]
a. 10^0 b. 30^0 c. 50^0 d. 11^0

16. In a 3-phase semi converter, for firing angle equal to 120 and extinction angle equal to 1000, none of the bridge elements conduct for [ ]
a. 10^0 b. 20^0 c. 30^0 d. 60^0

17. A 3-phase semi converter can work as [ ]
a. Converter for $\alpha = 0^0$ to 180^0 b. Converter for $\alpha = 0^0$ to 90^0
c. inverter for $\alpha = 90^0$ to 180^0 d. Inverter for $\alpha = 0^0$ to 90^0

18. In a 3-phase semi converter, the three SCRs are triggered at an interval of [ ]
a. 60^0 b. 90^0 c. 120^0 d. 180^0

19. In a 3-phase full converter, the six SCRs fired at an interval of [ ]
a. 30^0 b. 60^0 c. 90^0 d.120^0

KEY: 1-B, 2-B, 3-A, 4-A, 5-C, 6-B, 7-A, 8-A, 9-C, 10-C, 11-D, 12-C, 13-A, 14-B, 15-C, 16-B, 17-A, 18-C, 19-B

UNIT-III

Diode-Clamped Multilevel Inverters

Unit-3:

1.What is a DC chopper, or DC -dc converter?
2.What is the principle of operation of a step up converter?
3.What is the pulse width modulation control of a converter?
4.What are the advantages and disadvantages of a variable frequency converter?
5.What is the effect of chopping frequency on the load ripple current?
6.What is the modulation index for PWM control?
7.What is a third and fourth quardent converter?
8.What are the performance parameter of a converter?
9.What is a switching mode regulation?
10.What are the advantages of a buck regulator?
11.What are the disadvantages of a boost regulator?
12.What are the advantages and disadvantages of a cock regulator?
13.At what duty cycle does the load ripple current become maximum?
14.What is a multi output boost converter?
15.How can the input current of the rectifier fed boost converter be made sinusoidal and inphase with the input voltage?
16.What is a state space averaging technique?

1. 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. $V_s . T_{on}/f$ *b.* $V_s.f/T_{on}$ *c.* $V_s/f.T_{on}$ *d.* $V_s.f.T_{on}$

2. In dc choppers, the waveforms for input and output voltages are respectively [

a. Discontinuous, continuous b. both continuous

b. c. both discontinuous d. continuous, discontinuous

3. A chopper can be used on [

a. Pulse-width modulation only b. Frequency modulation only

c. amplitude modulation only d. both PWM and FM

4. In PWN method of controlling the average output voltage in a chopper, [

1. On-time Ton is varied and chopping frequency *f* is kept constant
2. T_{on} is kept constant and *f* is varied
3. Both T_{on} and off-time T_{off} are varied and *f* is kept constant
4. T_{off} is varied and T is kept constant

From above, the correct statements are

a. 1,3 b. 1,3,4 c. 2,3,4 d. 3,4.Tech III Year I Sem Course File

5. In FM method of controlling the average output voltage in a chopper, [
1. On-time T_{on} is kept constant and chopping period *T* is varied
2. Turn off time T_{off} is kept constant and *T* is varied
3. T_{on} is kept constant and T_{off} is varied
4. T_{off} is kept constant and T_{on} is varied

From there the correct statements are

a. 1,3,4 b. 2,3,4 c. 1,2,3,4 d. 1,2,3

6. A. Step-down chopper is operated in the continuous conduction mode in steady state with a constant duty ratio D . If V_0 is the magnitude of the dc output voltage and if V_s is the magnitude of the dc output voltage, the ratio V_0/V_s is given by [

a. D b. 1-D c. d.

7. For type-A chopper, V_s is the source voltage, R is the load resistance and α is the duty cycle.
The average output voltage and current for this chopper are respectively [
a. α V_s, α.(V_s/R) (b) (1-α)V_s, (1-α) V_s/R c. V_sα/, V_s/αR d. V_s/(1-α), V_s/(1-α)R

8. For type-A chopper, Vs as the source voltage, r as the load resistance and α as the duty cycle.
For this chopper, Rms value of output voltage is [
a. αV_s b. . V_s c. Vs/ d. .V_s

9. In dc choppers, per unit ripple is maximum when duty cycle α is [
a. 0.2 b. 0.5 c. 0.7 d. 0.9

10. A load commutated chopper, fed from 200 V dc source, has a constant load current of 50 A.
For a duty cycle of 0.4 and chopping frequency of 2 kHz, the value of commutating capacitor and the turn-off time for one thyristor pair are respectively [
(a) 25µ F, 100µs b. 50µ F, 50µs c. 25µ F, 25µs d. 50µ F, 25µs

11. A dc battery is charted from a constant dc source of 200 V through a chopper. The dc battery is to be charged from its internal emf of 90 to 120 V. The battery has internal resistance of 1 Ω. For a constant charging current of 10A the range of duty cycle is [
a. 0.45 to 0.6 b. 0.5 to 0.65 c. 0.4 to 0.55 d. 0.5 to 0.6

12. For type-A chopper: V_s R, I_0 and α are respectively the dc source voltage, load resistance, constant load current and duty cycle. For this chopper, average and rms [
a. αI_0, , I_0 b. $(1-\alpha)I_0$, . I_0 c. α.Vs/R, V_s/R d. $(1-\alpha)\ I_0$, .I_0

13. A step-up chaopper has Vs 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. $V_s(1-\alpha)$ $V_s/(1+\alpha)$

14. A dc chopper is fed from 100 V dc. Its load voltage consists of rectangular pulses of duration 1 msec in an overall cycle time of 3 msec. The average output voltage and ripple factor for this chopper are respectively [
a. 25 V, 1 b. 50 V, 1 c. 33.33 V, d. 33.33 V, 1

15. When a series LC circuit is connected to a dc supply of V volts through a thyristor then the peak current through thyristor is [

a. V. b. V/ c. V. d. V.

16. In type-A chopper, source voltage is 100 V dc, on-period = µs, off-period=150µs and load RLE consists of R= 2Ω, L=5 mH, E=10V. For continuous conduction, average output current for this chopper are respectively [
a. 40 V, 15 A b. 66.66 V, 28.33 A c. 60 V, 25 A d. 40 V , 20 A

17. A step-up chopper is fed from a 220 V dc to deliver a load voltage of 660 V. If the non-conduction time of the thyristor is 100 µs, the required pulse width would be [
a. 100 µs b. 200 µs c. 220 µs d. 660 µs

18. A chopper, where voltage as well as current remains negative, is known as [
a. Type-A b. Type-B c. Type-C d. Type-D

19. A chopper, in which current remains positive but voltage may be positive or

negative, is known as
a. Type-A b. Type-B c. Type-C d. Type-D [

20. For eliminating fifth harmonic from the output voltage wave of a dc chopper, the ripple factor should be [
a. 1 b. 2 c.3 d. 4

KEY: 1-D, 2-D, 3-D, 4-B, 5-C, 6-A, 7-A, 8-B, 9-B, 10-A, 11-B, 12-B, 13-B, 14-C, 15-C, 16-A, 17-B, 18-B, 19-D, 20-B

UNIT-IV- DC-DC Switch-Mode Converters & Switching DC Power Supplies

Unit-4:
1.What are the normal specifications of power supplies?
2.What are the types of power supplies in general?
3.Name three types of DC and AC power supplies?
4.What are the advantages and disadvantages of switched power supplies?
5.What are the advantages and disadvantages of bidirectional power supplies?
6 What are the advantages and disadvantages of half bridge converter?
7.What are the advantages and disadvantages of half bridge converter?
8.What are the various configuration of resonant DC power supplies?
9.What is the general arrangement of UPS system?
10.What are the problems of the transformer core?
11.What are the two commonly used control methods for power supplies?
12.Why is the design of a DC inductor different from that of an AC indicator?

1. Single-phase voltage controller feeds an induction motor (A) and a heater (B) [
a. In both the loads, fundamental and harmonics are useful
b. In A only fundamental and in B only harmonics are useful
c. In a only fundamental and in B harmonics as well as fundamental are useful
d. In a only harmonics and in B only fundamental are useful

2. A load resistance of 10Ω is fed through a 1-phase voltage controller from a voltage source of 200 sin 314t. For a firing a angle delay of 90^0 the power delivered to load in kW, is [
a. 0.5 b. 0.75 c. 1 d. 2.

3. A single-phase voltage controller is employed for controlling the power flow from 260V, 50Hz

source into a load consisting of R=5Ω and ωL=12Ω. The value of maximum rms load current and the firing angle are respectively [

a. 20A, 0^0 b. , A, 0^0 c. 20A, 90^0 d.

4. A load, consisting of R=10Ω and ωL=10Ω, is being fed from 230V, 50Hz, source through a 1-
phase voltage controller. For a firing angle delay of 300, the rms value of load current would be

a. 23 A b. c. > d. <

5. In a single-phase voltage controller with RL load, ac output power can be controlled if
a. firing angle $\alpha>\varphi$ (load phase angle and conduction angle $\gamma=\pi$ [
b. $\alpha > \varphi$ and $\gamma < \pi$ c. $\alpha< \varphi$ and $\gamma < \pi$ d. $\alpha > \varphi$ and $\gamma > \pi$

6. A single-phase voltage controller feeds power to a resistance of 10Ω. The source voltage is 200
V rms. For a firing angle of $90^{0,}$ the rms value of thyristor current in amperes is [
a. 20 b. 15 c. 10 d. 5

7. A single-phase voltage controller is connected to a load of resistance 10 Ω and a supply of 200
sin 314*t* volts. For a firing angle of 60^0, the average thyristor current in amperes is [

a.10 b. 10/π c. 5 d. 5

8. A single-phase voltage controller, using two SCRs in antiparallel, is found to be operating as a
controlled rectifier. This is because [
a. load is r and pulse gating is used b. load is R and high-frequency carrier gating is used
c. Load is RL and pulse gating is used d. load is RL and continuous gating is used

9. a single-phase ac voltage controller (or regulator) fed from 50Hz system supplies a load having
resistance and inductance of 2.0 Ω and 6.36 mH respectively. The control range of firing angle for this regulator is [
a. $0^0 < \alpha < 180^0$ b. $45^0 < \alpha < 180^0$ c. $90^0 < \alpha < 180^0$ d. $0^0 < \alpha < 45^0$

10. Two identical SCRs are connected back to back in series with a load. If each SCR is fired at
60^0, a PMMC voltmeter across the load would read [

a. peak voltage b. x peak voltage c. zero d. x peak voltage

11.A cycloconverter is a frequency converter from [
a. Higher to lower frequency with one-stage conversion
b. Higher to lower frequency with two-stage conversion
c. Lower to higher frequency with one-stage conversion
d. Ac to one frequency to dc and then dc to ac at a different frequency From these, the correct statements are
(a)2,4 (b) 1 only (c) 2,3 (4) 1,3

12The cycloconverters (CCs) re quire 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 step-up CCS d. Forced commutation in step-down CCs

13.Consider the following statements regarding cycloconverters [
1. In 1-phase to 1-phase CC, firing angle may be varied
2. In 3-phase to 1-phaseCC, firing angle may be kept constant
3. In 1-phase to 1-phase CC, firing angle may be kept constant
4. In 3-phase to 1-phase CC, firing angle may be varied
5. In 3-phase to 1-phaseCC, firing angle mast be varied From these, the correct statements are
(b) 2,4,5 (b) 1,3,5 (c) 2,3,5 (d) 2,3,4

14. Three-phase to three-phase cycloconvers employing 18 SCRs and 36 SCRs have the same voltage and current rating for their component thyristors. The ratio of VA rating of 36-SCR
device to that of 18-SCR device is [
a. ½ b. 1 c. 2 d. 4

15. Three-phase to 3-phase cycloconverters employing 18 SCRs and 36 SCRs have the same voltage and current rating for their component thyristors. The ratio of power output from 36-SCR converter to that out patted by 18-SCR converter is [
a. 4 b. 2 c. 1 d. ½

16. The number of thyristors required for single-phase to single-phase cycloconverter of the mid-
point type and for three phase to three-phase to three-phase 3-pulse type cycloconverter are respectively
(a)4,6 b. 8, 18 c. 4,18 d. 4,36 [

17. A 3-phase to single-phase conversion device employs a 6-pulse bridge cycloconverter. For an

output voltage of 200 V per phase the fundamental rms value of output voltage is [
a. 600/π V (b) 300 / π V c. 300/π V d. 600 / π V

18. A three-phase to single-phase cycloconverter consists of positive and negative group of converters. In this device one of the two component converters would operate as a [
1. Rectifier if the output voltage V_0 and I_0 have the same polarity
2. Rectifier if V_0 and I_0 have the same polarity
3. Rectifier if V_0 and I_0 are of opposite polarity
4. Inverter if V_0 and I_0 are opposite polarity
From above, the correct statements are
a) 1,4 b. 2,3 c. 3,4 d. 1,2

19. A 3-phase to 3-phase cycloconverter requires [
1. 18 SCRs for 3-pulse device
2. 18 SCRs for 6-pulse device
3. 36 SCRs for 3-pulse device
4. 36 SCRs for 6-pulse device
From above, the correct statements are
a) 1,3 b. 2,3 c. 2,4 d. 1,4

20. Which of the following statements are correct for cycloconverters? [
1. Step-down cycloconverter (cc) works on natural commutation
2. Step-up cc requires forced commutation
3. Load commutated cc works on line commutation
4. Load commutated cc requires a generated emf in the load circuit From above, the correct statements are
a) 1,2 b. 1, 2,4 c. 2,3, 4 d. 1,2,3

KEY: 1-C, 2-C, 3-A, 4-B, 5-B, 6-C, 7-B, 8-C, 9-B, 10-C, 11-D, 12-C, 13-B, 14-C, 15-A, 16-C,

17-D, 18-A, 19-D, 20-B

UNIT-V

Resonant Converters & Power Conditioners And Uninterruptible Power Supplies

1.What is the principle of series resonant inverter?
2.What is the dead zone of a resonant inverter?
3.What are the advantages and disadvantages of resonant inverter with unidirectional switches?
4.What is the necessary condition for series resonant oscillation?

5.What is an overlap control of resonant inverter?
6.What are the effects of series loading in A series resonant inverter ?
7.What are the methods for voltage control of series resonant inverter?
8.What is the class E resonant inverter and rectifier?
9.What are the advantages and limitations of class E resonant frequency?
10.What is the principle of Zero current switching (ZCS) resonant converter?
11.What are the advantages and limitations of zero voltage switching (zvs) converter?
12.What is the purpose of coupled indicators in half bridge resonant inverter?

1. If, for a single-phase half-bridge inverter, the amplitude of output voltage is V_s and the output power is P, then their corresponding values for a single-phase full-bridge inverter are
a. V_s, P b. $2V_s$, P c. $2V_s$, 2P d. $2V_s$, 4P [ ]

2. In voltage source inverters [ ]
a. Load voltage waveform $V0$ depends on load independence Z, whereas load current waveform i_0 does not depend on Z
b. Both V_0 and i_0 depend on Z
c. V_0 does not depend on Z whereas i_0 depends on Z
d. Both V_0 and i_0 do not depend upon Z

3. A single-phase full bridge inverter can operate in load-communication mode in case load consists of [ ]
a. RL b. RLC under damped c. RLC over damped d. RLC critically damped
4. A single-phase bridge inverter delivers power to a series connected RLC load with R= 2Ω , ωL=8Ω. For this inverter-load combination, load commutation is possible in case the magnitude of 1/ωC in ohms is [ ]
a. 10 b. 8 c. 6 d. zero

4. For a 3-phase bridge inverter in 1800 conduction mode, Fig C.50, 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, 5c. 3,4,5 and 5,6,1 d. 5,6,1 and 6,1,2

5. For a 3-phase bridge inverter in 1200 conduction mode Fig. C. 50, the sequence of SCR conduction in the first two steps, beginning with the initiation of thyristor 1, [ ]
a. 6,1 and 1,2 b. 1,2 and 2,3 c. 1,6 and 5,6 d. 1,3 and 3,4

6. 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

7. In a single-pulse modulation of PWM inverters, fifth harmonic can be eliminated if pulse
width is equal to [ ]

a. 30^0 b. 72^0 36^0 d. 108^0

8. In a single-pulse modulation of PWM inverters, the pulse width is 1200. For an input voltage of 220 V dc, the r.m.s. value of output voltage is [ ]
a. 179.63 V b. 254.04 V c. 127.02 V d. 185.05 V

9. In a single-pulse modulation used in PWM inverters, Vs is the input dc voltage. For eliminating third harmonic, the magnitude of rms value of fundamental component of output voltage and pulse width are respectively [ ]

10. In multiple-pulse modulation used in PWM inverters, the amplitudes of reference square wave and triangular carrier wave are respectively 1V and 2V. for generating 5 pulses per half cycle, the pulse width should be [ ]
a. 36^0 b. 24^0 c. 18^0 d. 12^0

11. In multiple-pulse modulation used in PWM, the amplitudes and frequency for triangular carrier and square reference signals are respectively 4V , 6kHz and 1V, 1KHz. The number of pulses per half cycle and pulse width are respectively [ ]
a. 6, 90^0 b. 3, 45^0 c. 4, 60^0 d. 3, 40^0

12. In sinusoidal-pulse modulation used in PWM inverters, amplitude and frequency for triangular carrier and sinusoidal reference signals are respectively 5V, 1kHz and 1V, 50 Hz. If zeros of the triangular carrier and reference sinusoid coincide, then the modulation index and order of significant harmonics are respectively [ ]
a. 0.2, 9 and 11 b. 0.4, 9 and 11 c. 0.2, 17 and 19 d. 0.2 and 21

13. Which of the following statement/statements is/are correct in connection with inverters
a. VSI and CSI both require feed back diodes [ ]
b. Only CSI requires feedback diodes
c. GTOs can be used in CSI
d. Only VSI requires feedback diodes.

14. In a CSI, if frequency of output voltage is f Hz , then frequency of voltage input to CSI is
a. f b. 2f c. f/2 3f [ ]

15. In sinusoidal-pulse modulation used in PWM inverters, amplitude and frequency of triangular carrier and sinusoidal reference signals are respectively 5V, 1kHz and 1V, 50 Hz. If peak of the triangular carrier coincides with the zero of the reference sinusoid, then the

modulation index and order or significant harmonics are[ ]
a. 0.2, 9 and 11 b. 0.4, 9 and 11 c. 0.2, 17 and 19 d. 0.2, 19 and 21

16. In sinusoidal PWM, there are 'm' cycles of the triangular carrier wave in the half cycle of reference sinusoidal signal. If zero of the reference sinusoid coincides with zero/peak of the
triangular carrier wave, then number of pulses generated in each half cycle are respectively
a. (m-1)/m b. (m-a)/(m-1) c. m/m d. m/(m-1) [ ]

17. In an inverter with fundamental output frequency of 50 Hz, if third harmonic is eliminated, then frequencies of other components in the output voltage wave, in Hz, would be [ ]
a. 250, 350, 450, high frequencies b. 50,250, 350, 450
c. 50,250, 350, 550 d. 50,100,200,250

18. 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

19. 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. step function d. pulsed wave

KEY: 1-D, 2-C, 3-B, 4-A, 5-D, 6-A, 7-C, 8-B, 9-A, 10-D, 11-C, 12-B, 13-C, 14-D, 15-B, 16-D, 17-A, 18-C, 19-B.