Department of Electrical and Electronics Engineering

EE8601 – SOLID STATE DRIVES

UNIT II

CONVERTER /CHOPPER FED DC MOTOR DRIVE

1. RLE load is a voltage stiff load.
a) True
b) False

Answer: b

2. In Half-wave uncontrolled rectifier calculate the average value of the voltage if the supply is 23sin(50t).
a) 7.32 V
b) 8.32 V
c) 9.32 V
d) 7.60 V

Answer: a

3. In Half-wave controlled rectifier calculate the average value of the voltage if the supply is 10sin(50t) and firing angle is 30°.
a) 2.32 V
b) 2.97 V
c) 4.26 V
d) 5.64 V

Answer: b

4. Calculate the extinction angle in purely inductive load if the firing angle is $\pi \div 4$.
a) 315°

b) 145°

c) 345°

d) 285°

Answer: a

5. Calculate the conduction angle in purely inductive load if the firing angle is $\pi \div 2$.

a) 205°

b) 175°

c) 180°

d) 195°

Answer: c

6. RLE load is also known as DC motor load.

a) True

b) False

Answer: a

7. In single phase RLE load, calculate the voltage across the thyristor when current decays to zero using the data: $(V_s)_{r.m.s}$=220 V, f=40 Hz, R=1 Ω, E=90 V, β=230°.

a) -328.33 V

b) -325.48 V

c) -254.85 V

d) -284.48 V

Answer: a

8. Calculate the displacement factor if the fundamental voltage is 24sin(140πt-240°) and fundamental current is 47sin(140πt-120°).

a) -0.5

b) -0.7

c) 0.9

d) 0.4

Answer: a

9. Calculate the PIV for the Mid-point configuration of Full-wave rectifier if the peak value of the supply voltage is 311.
a) 622 V
b) 620 V
c) 624 V
d) 626 V

Answer: a

10. Calculate the average value of the current through the thyristor in case of 1-Φ Full wave bridge rectifier if the value of the load current is 42 A.
a) 21 A
b) 12 A
c) 14 A
d) 16 A

Answer: a

11. Calculate the r.m.s value of the current through the thyristor in case of 1-Φ Full wave bridge rectifier if the value of the load current is 2 A.
a) 1.414 A
b) 1.214 A
c) 1.347 A
d) 1.657 A

Answer: a

12. Calculate the value of THD value for 1-Φ Full wave bridge rectifier.
a) 48.43 %
b) 47.25 %
c) 49.26 %
d) 50.48 %

Answer: a

13. Calculate the value of the Input power factor for 1-Φ Full wave bridge rectifier if the firing angle value is 45°.

a) .65

b) .64

c) .61

d) .63

Answer: d

14. Calculate the value of the fundamental displacement factor for 1-Φ Full wave bridge rectifier if the firing angle value is 60°.

a) .5

b) .4

c) .2

d) .8

Answer: a

15. Calculate the value of the fundamental displacement factor for 1-Φ Full wave semi-converter if the firing angle value is 20°.

a) .82

b) .98

c) .74

d) .26

16. In Half-wave controlled rectifier calculate the average value of the voltage if the supply is 13sin(25t) and firing angle is 13°.

a) 4.08 V

b) 4.15 V

c) 3.46 V

d) 5.48 V

Answer: a

17. Calculate the extinction angle in purely inductive load if the firing angle is 13°.
a) 328°
b) 347°
c) 349°
d) 315°

Answer: b

18. Calculate the conduction angle in purely inductive load if the firing angle is 165°.
a) 78°
b) 55°
c) 30°
d) 19°

Answer: c

19. R-L-C underdamped loads are generally lagging power factor loads.
a) True
b) False

Answer: b

20. In Half-wave uncontrolled rectifier calculate the average value of the voltage if the supply is 3sin(5t).
a) .95 V
b) .92 V
c) .93 V
d) .94 V

Answer: a

21. In Half-wave uncontrolled rectifier calculate the r.m.s value of the voltage if the supply is 89sin(41t).
a) 91.5 V
b) 44.5 V
c) 25.1 V
d) 15.1 V

Answer: b

22. In Half-wave uncontrolled rectifier calculate the power dissipation across the 8 Ω resistor if the supply is 29sin(22t).
a) 26.2 W
b) 24.2 W
c) 26.1 W
d) 29.1 W

Answer: a

23. The conduction period of diode in Half-wave uncontrolled rectifier for resistive load is
_____
a) π
b) 2π
c) 3π
d) 4π

Answer: a

24. In Half-wave uncontrolled rectifier calculate the average value of the current for 3 Ω resistive load if the supply is 34sin(11t).
a) 3.6 A
b) 2.6 A
c) 2.5 A
d) 3.1 A

Answer: a

25. In Half-wave controlled rectifier calculate the average value of the current for 2.5 Ω resistive load if the supply is sin(5.2t) and firing angle is 26°.

a) 0.8 V

b) 0.15 V

c) 0.12 V

d) 0.21 V

Answer: c

26. Calculate the circuit turn-off time for Half-wave controlled rectifier for a ω=5 rad/sec for resistive load.

a) .62 sec

b) .42 sec

c) .58 sec

d) .64 sec

Answer: a

27. Calculate the string efficiency if the de-rating factor is .429.

a) 48.1 %

b) 57.1 %

c) 47.8 %

d) 46.5 %

Answer: b

28. Calculate the output frequency for the six-pulse converter if the supply frequency is 10 Hz.

a) 40 Hz

b) 30 Hz

c) 60 Hz

d) 80 Hz

Answer: c

29. Calculate the pulse number if the supply frequency is 2π and the output frequency is π÷6.

a) 4

b) 12
c) 16
d) 8

Answer: b

30. Volt-sec balance method is based on the principle of the energy of conservation.
a) True
b) False

Answer: a

31. Calculate the value of the Input power factor for 1-Φ Full wave bridge rectifier if the firing angle value is 39°.
a) .69
b) .59
c) .78
d) .15

Answer: a

32. Calculate the value of the fundamental displacement factor for 1-Φ Full wave bridge rectifier if the firing angle value is 38°.
a) .22
b) .78
c) .33
d) .44

Answer: b

33. Calculate the value of the fundamental displacement factor for 1-Φ Full wave semi-converter if the firing angle value is 69°.
a) .48
b) .24
c) .82

d) .88

Answer: c

34. Calculate the fundamental component of source current in 1-Φ Full wave bridge rectifier for load(Highly inductive) current=3.14 A.
a) 2.82 A
b) 1.45 A
c) 3.69 A
d) 4.78 A

Answer: a

35. Calculate the circuit turn-off time for 1-Φ Full wave bridge rectifier for α=145°. Assume the value of ω=5 rad/sec.
a) 84.9 msec
b) 94.5 msec
c) 101.2 msec
d) 87.2 msec

Answer: d

36. Calculate the fundamental component of source current in 1-Φ Full wave bridge rectifier for the load(Highly inductive) current=78 A.
a) 78 A
b) 45 A
c) 69 A
d) 13 A

Answer: a

37. Calculate the r.m.s value of source current in 1-Φ Full wave semi-converter for the load (Highly inductive) current=51.2 A and α=15°.
a) 10.53 A
b) 14.52 A
c) 44.92 A

d) 49.02 A

Answer: d

38. Calculate the r.m.s value of thyristor current in 1-Φ Full wave semi-converter for the load (Highly inductive) current=2.2 A and α=155°. (Asymmetrical configuration)
a) .58 A
b) .57 A
c) .51 A
d) .52 A

Answer: b

39. Calculate the r.m.s value of diode current in 1-Φ Full wave semi-converter for the load (Highly inductive) current=5.1 A and α=115°. (Asymmetrical configuration)
a) 4.21 A
b) 4.61 A
c) 4.71 A
d) 4.52 A

Answer: b

40. Calculate the average value of thyristor current in 1-Φ Full wave semi-converter for the load (Highly inductive) current=25.65 A and α=18°. (Asymmetrical configuration)
a) 11.54 A
b) 12.15 A
c) 15.48 A
d) 14.52 A

Answer: a

41. Calculate the average value of diode current in 1-Φ Full wave semi-converter for the load (Highly inductive) current=75.2 A and α=41°. (Asymmetrical configuration)
a) 46.16 A
b) 42.15 A
c) 41.78 A

d) 41.18 A

Answer: a

42. Calculate the average value of diode current in 1-Φ Full wave semi-converter for the load (Highly inductive) current=5.2 A and α=11°. (F.D configuration)
a) .32 A
b) .31 A
c) .25 A
d) .27 A

Answer: b

43. Calculate the r.m.s value of diode current in 1-Φ Full wave semi-converter for the load (Highly inductive) current=.2 A and α=74°. (F.D configuration)
a) .154 A
b) .248 A
c) .128 A
d) .587 A

Answer: c

44. Diodes in 1-Φ Full wave semi-converter protects the thyristor from short-circuiting.
a) True
b) False

Answer: a

45. The problem of short-circuiting in 1-Φ Full wave semi-converter is very common.
a) True
b) False

Answer: a

46. For α > 90°, 3-Φ Full wave bridge rectifier acts as a natural commutated inverter.
a) True
b) False

Answer: a

47. What is the formula for output voltage for 3-Φ Full wave bridge rectifier for R-L load?
a) $3V_{ml}(\cos(\alpha)) \div 2\pi$
b) $3V_{ml}(\cos(\alpha)) \div \pi$
c) $2V_{ml}(\cos(\alpha)) \div \pi$
d) $6V_{ml}(\cos(\alpha)) \div \pi$

Answer: b

48. The output voltage of 3-Φ Full wave bridge rectifier is six times of 3-Φ Half-wave rectifier.
a) True
b) False

Answer: b

49. What is the formula for output voltage for 3-Φ Full wave bridge rectifier for R load for α < 60°?
a) $2V_{ml}(\cos(\alpha)) \div \pi$
b) $3V_{ml}(\cos(\alpha)) \div 2\pi$
c) $3V_{ml}(\cos(\alpha)) \div \pi$
d) $6V_{ml}(\cos(\alpha)) \div \pi$

Answer: c

50. _____ is the boundary for C.C.M and D.C.M mode in 3-Φ Full wave bridge rectifier for R load.
a) 60°
b) 10°
c) 80°
d) 50°

Answer: a

51. What is the formula for output voltage for 3-Φ Full wave bridge rectifier for R load for α > 60°?
a) $2V_{ml}(1+\cos(\alpha+60°))\div\pi$
b) $3V_{ml}(1+\cos(60°+\alpha))\div2\pi$
c) $3V_{ml}(1+\cos(60°+\alpha))\div\pi$
d) $6V_{ml}(\cos(\alpha))\div\pi$

Answer: c

52. Calculate the r.m.s value of thyristor current in 3-Φ Full wave converter for the load current=4 A and α=12°.
a) 2.3 A
b) 2.5 A
c) 2.7 A
d) 2.9 A

Answer: a

53. Calculate the average value of thyristor current in 3-Φ Full wave converter for the load current=9 A and α=26°.
a) 4 A
b) 5 A
c) 7 A
d) 3 A

Answer: d

54. Calculate the De-rating factor if the string efficiency is 16 %.
a) .84
b) .44
c) .5
d) .6

Answer: a

55. Full form of MOSFET is _____
a) Metal oxide silicon field effect transistor
b) Metal oxide semiconductor field effect transistor
c) Metal oxide settle field effect transistor
d) Metal oriented silicon field effect transistor

Answer: b

56. Full form of FET is _____
a) Field effect transistor
b) Field engage transistor
c) Field effect terminal
d) Fire engage transistor

Answer: a

57. Calculate the compensator rating required for $\sin(\Phi) = .13$.
a) 0.45 P.U
b) 0.12 P.U
c) 0.13 P.U
d) 0.82 P.U

Answer: c

58. Full form of DIAC is _____
a) Digital Alternating current
b) Discrete Alternating current
c) Diode for Alternating current
d) Digital Alternating counter

Answer: c

59. Which harmonic is not present in 3-Φ fully controlled rectifier?

a) 81$_{st}$ harmonic

b) 15th harmonic

c) 17th harmonic

d) 11th harmonic

Answer: a

60. Fifth lowest order harmonic present in 3-Φ fully controlled rectifier is _____

a) 15th

b) 17th

c) 13th

d) 12th

Answer: b.

61. Choppers are used to control the DC voltage level.

a) True

b) False

Answer: a

62. Which one of the following device is uncontrolled?

a) SCR

b) MOSFET

c) Diode

d) TRIAC