Subject: - Fundamentals of Power Electronics (22326)

SYLLABUS

Chapter No.	Name of chapter	Marks With Option
1	Power Electronics Devices	18
2	Thyristor Family Devices	18
3	Turn On and Turn Off Methods of Thyristor	28
4	Phase controlled Rectifiers	22
5	Industrial control circuits	16
	Total Marks: -	**102**

BOARD THEORY PAPER PATTERN FOR FPE (22326)

Q.1		**Attempt any FIVE** **5*2=10**
	a)	Power Electronics Devices
	b)	Turn On and Turn Off Methods of Thyristor
	c)	Turn On and Turn Off Methods of Thyristor
	d)	Power Electronics Devices
	e)	Phase controlled Rectifiers
	f)	Power Electronics Devices
	g)	Industrial control circuits
Q.2		**Attempt any THREE** **3*4=12**
	a)	Thyristor Family Devices
	b)	Power Electronics Devices
	c)	Turn On and Turn Off Methods of Thyristor
	d)	Phase controlled Rectifiers

Q.3		**Attempt any THREE** **3*4=12**
	a)	Industrial control circuits
	b)	Thyristor Family Devices
	c)	Turn On and Turn Off Methods of Thyristor
	d)	Power Electronics Devices
Q.4		**Attempt any THREE** **3*4=12**
	a)	Phase controlled Rectifiers
	b)	Power Electronics Devices
	c)	Industrial control circuits
	d)	Thyristor Family Devices
	e)	Turn On and Turn Off Methods of Thyristor
Q.5		**Attempt any TWO** **2*6=12**
	a)	Phase controlled Rectifiers
	b)	Turn On and Turn Off Methods of Thyristor
	c)	Thyristor Family Devices
Q.6		**Attempt any TWO** **2*6=12**
	a)	Industrial control circuits
	b)	Phase controlled Rectifiers
	c)	Turn On and Turn Off Methods of Thyristor

CLASS TEST - I

PAPER PATTERN

COURSE: - Fundamentals of Power Electronics (22326)

PROGRAMME: - Electrical Engineering

Syllabus: -

Unit No.	Name of the Unit	Course Outcome (CO)
1	**Power Electronics Devices**	**CO-326.1**
2	**Thyristor Family Devices**	**CO-326.2**
3	**Turn On and Turn Off Methods of Thyristor**	**CO-326.3**

Q.1	**Attempt any FOUR** 4*2=8Marks	Course Outcome (CO)
a)	Power Electronics Devices	CO-326.1
b)	Thyristor Family Devices	CO-326.2
c)	Turn On and Turn Off Methods of Thyristor	CO-326.3
d)	Thyristor Family Devices	CO-326.2
e)	Turn On and Turn Off Methods of Thyristor	CO-326.3
f)	Power Electronics Devices	CO-326.1
Q.2	**Attempt any THREE 3*4=12 Marks**	
a)	Turn On and Turn Off Methods of Thyristor	CO-326.3
b)	Power Electronics Devices	CO-326.1
c)	Thyristor Family Devices	CO-326.2
d)	Thyristor Family Devices	CO-326.2

CLASS TEST - II

PAPER PATTERN

COURSE: - Fundamentals of Power Electronics (22326)

PROGRAMME: - Electrical Engineering

Syllabus: -

Unit No.	Name of the Unit	Course Outcome (CO)
4	**Phase controlled Rectifiers**	**CO-326.4**
5	**Industrial control circuits**	**CO-326.5**

Q.1	Attempt any FOUR 4*2=8Marks	Course Outcome (CO)
a)	Phase controlled Rectifiers	CO-326.4
b)	Industrial control circuits	CO-326.5
c)	Phase controlled Rectifiers	CO-326.4
d)	Industrial control circuits	CO-326.5
e)	Phase controlled Rectifiers	CO-326.4
f)	Industrial control circuits	CO-326.5
Q.2	Attempt any THREE 3*4=12 Marks	
a)	Phase controlled Rectifiers	CO-326.4
b)	Industrial control circuits	CO-326.5
c)	Industrial control circuits	CO-326.5
d)	Phase controlled Rectifiers	CO-326.4

COURSE OUTCOME (CO)

COURSE: - Fundamentals of Power Electronics (22326)

PROGRAMME: - Electrical Engineering

CO. NO.	Course Outcome
CO-326.1	Select power electronic devices for specific application.
CO-326.2	Maintain the performance of Thyristors.
CO-326.3	Troubleshoot Turn On & Turn Off Circuits of Thyristors.
CO-326.4	Maintain Phase Controlled Rectifiers.
CO-326.5	Maintain Industrial Control Circuits

1. Power Electronics Devices

Position in Question Paper **Total Marks-18**

Q.1. a) 2-Marks.
Q.1. d) 2-Marks.
Q.1. f) 2-Marks.
Q.2. b) 4-Marks.
Q.3. d) 4-Marks.
Q.4. b) 4-Marks.

Descriptive Question

1. Draw VI characteristics of power transistor. Label different regions.
2. Draw the labeled constructional diagram of N-channel IGBT
3. Explain the secondary breakdown in power BJT and how it can be avoided.
4. State advantages of power transistor (any two)
5. Draw the symbol & vertical structure of power transistor and explain.
6. Describe the construction of IGBT.
7. Draw the symbol of MOSFET and IGBT
8. Draw the characteristics of power BJT. Explain Quasi-saturation.
9. State the types of power MOSFETS. Explain the working of any one type with Constructional diagram.
10. Compare 'Power BJT' with 'Power MOSFET' for their performance factor, Construction and area of applications

MCQ Question

(Total number of Question=Marks*3=06*3=18)

Note: Correct answer is marked with **bold.**

1. _____ of the following devices does not belong to the transistor family?
   a) IGBT
   c) **GTO**
   b) MOSFET
   d) BJT

2. A power transistor is a
   a) three layer, three junction device
   c) two layer, one junction device
   b) **three layer, two junction device**
   d) four layer, and three junction device

3. In a power transistor, ____ is the controlled parameter.
   a) V_{BE}
   c) I_B
   b) V_{CE}
   d) **I_C**

4. A power transistor is a _____ device.
   a) two terminal, bipolar, voltage controlled
   b) two terminal, unipolar, current controlled
   c) three terminal, unipolar, voltage controlled
   d) **three terminal, bipolar, current controlled**

5. In a power transistor, _____ is the controlling parameter.
   a) V_{BE}
   c) **I_B**
   b) V_{CE}
   d) I_C

6. In a power transistor, the I_B vs V_{BE} curve is
   a) a parabolic curve
   c) **resembling the diode curve**
   b) an exponentially decaying curve
   d) a straight line Y = I_B

7. The MOSFET combines the areas of _____ & _____
   a) **Field effect & MOS technology**
   c) MOS technology & CMOS technology
   b) semiconductor & TTL
   d) none of the mentioned

8. _____of the following terminals does not belong to the MOSFET?
   a) Drain
   c**) Base**
   b) Gate
   d) Source

9. Choose the correct statement

a) MOSFET is a uncontrolled device
c) MOSFET is a current controlled device
b) **MOSFET is a voltage controlled device**
d) MOSFET is a temperature controlled device

10. Choose the correct statement(s)

i) The gate circuit impedance of MOSFET is higher than that of a BJT
ii) The gate circuit impedance of MOSFET is lower than that of a BJT
iii) The MOSFET has higher switching losses than that of a BJT
iv) The MOSFET has lower switching losses than that of a BJT

a) Both i & ii
c**) Both i & iv**
b) both ii & iv
d) Only ii

11. Choose the correct statement

a) MOSFET is a unipolar, voltage controlled, two terminal device
b) MOSFET is a bipolar, current controlled, three terminal device
c) **MOSFET is a unipolar, voltage controlled, three terminal device**
d) MOSFET is a bipolar, current controlled, two terminal device

12. IGBT possess

a) Low input impedance
b) **high input impedance**
c) high on-state resistance
d) second breakdown problems

13. IGBT & BJT both possess ___

a) **low on-state power losses**
c) low switching losses
b) high on-state power losses
d) high input impedance

14. The three terminals of the IGBT are

a) base, emitter & collector
c) **gate, emitter & collector**
b) gate, source & drain
d) base, source & drain

15. In IGBT, the p^+ layer connected to the collector terminal is called as the

a) drift layer
c) body layer
b) **injection layer**
d) collector Layer

16. The controlling parameter in IGBT is the

a) I_G c) I_C

b) **V_{GE}** d) V_{CE}

17. The voltage blocking capability of the IGBT is determined by the

a) Injection layer c) metal used for the contacts

b) body layer d) **drift layer**

18**.** The structure of the IGBT is a

a) P-N-P structure connected by a MOS gate

b) N-N-P-P structure connected by a MOS gate

c) **P-N-P-N structure connected by a MOS gate**

d) N-P-N-P structure connected by a MOS gate

2. Thyristors Family Devices

Position in Question Paper **Total Marks-18**

Q.2. a) 4-Marks.
Q.3. b) 4-Marks
Q.4. d) 4-Marks.
Q.5. c) 6-Marks.

Descriptive Question

1. Name any two triggering devices used for triggering SCR
2. State any two advantages of IGBT.
3. List two applications of TRIAC.
4. Sketch equivalent circuit of SCR using BJT. Describe its working principle.
5. Differentiate SCR and TRIAC with respect to (i) symbol, (ii) layered diagram, (iii) Operating quadrant, (IV) application.
6. Draw constructional diagram of GTO and state its operating principle.
7. Draw symbol and characteristics of DIAC and SUS.
8. Describe the working of DC flasher circuit using SCR with neat diagram.
9. State two applications each for (i) SCR and (ii) PUT.
10. Draw the symbols of (i) SCR (ii) DIAC
11. Define holding and latching current.
12. Compare SCR & TRIAC. (Any four points)
13. Draw and explain the VI characteristics of UJT.
14. Draw and explain the VI characteristics of SCR.

MCQ Question

(Total number of Question=Marks*3=17*3=51)

Note: Correct answer is marked with **bold**

1. A Thyristor (SCR) is a

a) P-N-P device
c**) P-N-P-N device**
b) N-P-N device
d) P-N device

2. _____terminal does not belong to the SCR?

a) Anode
c) **Base**
b) Gate
d) Cathode

3. An SCR is a

a) four layer, four junction device
c) four layer, two junction device
b) **four layer, three junction device**
d) three layer, and single junction device

4. Choose the false statement.

a) **SCR is a bidirectional device**
c) In SCR the gate is the controlling terminal
b) SCR is a controlled device
d) SCR are used for high-power applications

5. In the SCR structure the gate terminal is located

a) Near the anode terminal
c) in between the anode & cathode terminal
b) **near the cathode terminal**
d) none of the mentioned

6. The static V-I curve for the SCR is plotted for

a) Ia (anode current) vs Ig (gate current), Va (anode – cathode voltage) as a parameter
b) **Ia vs Va with Ig as a parameter**
c) Va vs Ig with Ia as a parameter
d) Ig vs Vg with Ia as a parameter

7. If the cathode of an SCR is made positive with respect to the anode & no gate current is applied then

a) all the junctions are reversed biased
b) all the junctions are forward biased
c) **only the middle junction is forward biased**
d) only the middle junction is reversed biased

8. For an SCR in the reverse blocking mode, (practically)

a) leakage current does not flow

b) leakage current flows from anode to cathode

c) **leakage current flows from cathode to anode**

d) leakage current flows from gate to anode

9. With the anode positive with respect to the cathode & the gate circuit open, the SCR is said to be in the

a) Reverse blocking mode
c) **forward blocking mode**
b) reverse conduction mode
d) forward conduction mode

10. For an SCR in the forward blocking mode (practically)

a) Leakage current does not flow

b) **leakage current flows from anode to cathode**

c) leakage current flows from cathode to anode

d) leakage current flows from gate to anode

11. The GTO (gate turn-off Thyristors) is a

a) **p-n-p-n device**
c) p-metal-n device
b) p-n-p device
d) p-n single junction device

12. The GTO can be turned off

a) by a positive gate pulse
c) by a negative anode-cathode voltage
b) **by a negative gate pulse**
d) by removing the gate puls

13. The anode current is ideally limited by the

a) Gate pulse amplitude
c) **load Impedance**
b) internal impedance of the device
d) gate circuit impedance

14. The forward break over voltage is the

a) anode-cathode voltage at which conduction starts with gate signal applied

b) **anode-cathode voltage at which conduction starts with no gate signal applied**

c) gate voltage at which conduction starts with no anode-cathode voltage

d) gate voltage at which conduction starts with anode-cathode voltage applied

15. For a forward conducting SCR device, as the forward anode to cathode voltage is increased

a) the device turns on at higher values of gate current

b) **the device turns on at lower values of gate current**

c) the forward impedance of the device goes on increasing

d) the forward impedance of the device goes on decreasing

16. A thyristor can be bought from the forward conduction mode to forward blocking mode
    a) the dv/dt triggering method
    b) applying a negative gate signal
    c) applying a positive gate signal
    d) **applying a reverse voltage across anode-cathode terminals**

17. Usually the forward voltage triggering method is not used to turn-on the SCR because
    a) it increases losses
    b) it causes noise production
    c) **it may damage the junction & destroy the device**
    d) relatively it's an inefficient method

18. Among the following, the most suitable method to turn on the SCR device is the
    a) **gate triggering method**
    b) dv/dt triggering method
    c) forward voltage triggering method
    d) temperature triggering method

19. The forward break over voltage is maximum when
    a) Gate current = ∞
    b) **Gate current = 0**
    c) Gate current = -∞
    d) It is independent of gate current

20. For the SCR to remain in the ON (conducting) state
    a) gate signal is continuously required
    b) **no continuous gate signal is required**
    c) no forward anode-cathode voltage is required
    d) negative gate signal is continuously required

21. The value of anode current required to maintain the conduction of an SCR even though the gate signal is removed is called as the
    a) Holding current
    b) **latching current**
    c) switching current
    d) peak anode current

22. In the reverse blocking mode the middle junction (J_2) has the characteristics of that of a
    a) Transistor
    b) **capacitor**
    c) inductor
    d) none of the mentioned

23. _____are semiconductor Thyristor devices which can be turned-on by light of appropriate wavelengths.
    a) LGTOs
    b) LASERs
    c) MASERs
    d) **LASCRs**

24. The minimum value of anode current below which it must fall to completely turn-off the device is called

a) **Holding current value**
c) switching current value
b) latching current value
d) peak anode current value

25. The latching current is _____ than the holding current

a) Lower
c) same as
b) **higher**
d) negative of

26. For effective turning off of the SCR after the anode current has reached zero value,

a) chargers are injected by applying reverse anode-cathode voltage
b) **chargers are removed by applying reverse anode-cathode voltage**
c) chargers are injected by applying gate signal
d) chargers are removed by applying gate signal

27. To avoid commutation failure

a) **circuit turn-off time must be greater than the thyristors turn-off time**
b) circuit turn-off time must be lesser than the thyristor turn-off time
c) circuit turn-off time must be equal to the thyristor turn-off time
d) none of the above mentioned

28. The gate characteristics of thyristor is a plot of

a) V_g on the X-axis & I_g on the Y-axis
c) V_a on the X-axis & I_g on the Y-axis
b) **I_g on the X-axis & V_g on the Y-axis**
d) I_g on the X-axis & V_a on the Y-axis

29. The area under the curve of the gate characteristics of thyristor gives the

a) Total average gate current
c) total average gate impedance
b) total average gate voltage
d) **total average gate power dissipation**

30. A tangent drawn from the Y-axis to the Pavg on the gate characteristics gives the value of the

a) Maximum value of gate-source resistance
b**) minimum value of gate-source resistance**
c) maximum value of gate-source power
d) minimum value of gate-source power

31. Higher the magnitude of the gate pulse

a) **lesser is the time required to inject the charges**
b) greater is the time required to inject the charges
c) greater is the value of anode current
d) lesser is the value of anode current

32. For an SCR, the gate-cathode characteristic has a slop of 130. The gate power dissipation is 0.5 watts. Find Ig

a) 0.62 A
c) **62 mA**
b) 620 mA
d) 6.2 mA

33. The two transistor model of the SCR can obtained by

a) bisecting the SCR vertically
b) bisecting the SCR horizontally
c) bisecting the SCRs top two & bottom two layers
d) **bisecting the SCRs middle two layers**

34. Latching current for an SCR is 100 mA, DC source of 200 V is also connected from the SCR to the L load. Compute the minimum width of the gate pulse required to turn on the device. Take L = 0.2 H.

a) 50 µsec
c) 150 µsec
b) **100 µsec**
d) 200 µsec

35. Latching current for an SCR is 100 mA, a dc source of 200 V is also connected to the SCR which is supplying an R-L load. Compute the minimum width of the gate pulse required to turn on the device. Take L = 0.2 H & R = 20 ohm both in series.

a) 62.7 µsec
c) 56.9 µsec
b) **100.5 µsec**
d) 81 µsec

36. The voltage safety factor (V_{SF}) for an SCR is the ratio of

a) peak working voltage & peak reverse repetitive voltage
b) dv/dt & di/dt
c) **peak repetitive reverse voltage & maximum value of input voltage**
d) peak repetitive reverse voltage & rms value of input voltage

37. The forward dv/dt rating of an SCR

a) **increases with increase in the junction temperature**
b) decreases with increase in the junction temperature
c) increases with decrease in the rms value of forward anode-cathode voltage
d) decreases with decrease in the rms value of forward anode-cathode voltage

38. The finger voltage of an SCR is

a) **minimum value of Vak to turn on the device with gate triggering**
b) maximum value of Vak to turn on the device with gate triggering
c) minimum value of Vak to turn on the device without gate triggering
d) maximum value of Vak to turn on the device without gate triggering

39. Which among the following anode current waveforms will have the minimum junction temperature?

a) 100 % DC
c) 50 % DC
b) **25 % DC**
d) AC

40. An SCR has half cycle surge current rating of 3000 A for 50 Hz. Calculate its one-cycle surge current rating

a) 3121.32 A
c) 3131.32 A
b) **2121.32 A**
d) 2131.32 A

41. For a SCR the maximum rms on-state current is 35 A. If the SCR is used in a resistive circuit for a rectangular wave with conduction angle of 90°. Calculate the average & rms currents respectively.

a) **I/4, I/2**
c) I/4, $I^2/2$
b) I/2, I/√2
d) I/4, I/√2

42. The thermal resistance between junction & the SCR (θ_{jc}) has the unit

a) Ω/°C
c) **°C/W**
b) W/Ω
d) ΩW/°C

43. di/dt protection is provided to the thryistor by

a) connecting an inductor in parallel across the load
b) **connecting an inductor in series with the load**
c) connecting an inductor in parallel across the gate terminal
d) connecting an inductor in series with the gate

44. The dv/dt protection is provided in order to

a) limit the power loss
c) **avoid accidental turn-on of the device**
b) reduce the junction temperature
d) avoiding sudden large voltage across the load

45. The effect of over-voltages on SCR are minimized by using

a) RL circuits
c) **Varistors**
b) Circuit breakers
d) di/dt inductor

46. Over-current protection in SCRs is achieved through the use of

a) Varistors
c) **F.A.C.L.F & C.B.**
b) Snubber Circuits
d) Zener diodes

47. _____ device from the thyristor family has its gate terminal connected to the n-type material near the anode.

a) SCR
c) **PUT**
b) RCT
d) SUT

48. The Programmable Unijunction Transistor (PUT) turns on & starts conducting when the

a) gate voltage exceeds anode voltage by a certain value

b) **anode voltage exceeds gate voltage by a certain value**

c) gate voltage equals the anode voltage

d) gate is given negative pulse w.r.t to cathode

49. The equivalent circuit of SUS (Silicon Unilateral Switch) consists of

a) a diode in series with a PUT

b) a diode in parallel with a PUT

c) **a diode in anti-parallel with a PUT**

d) two diodes

50. From the following list of devices, choose the device that only turns-on for a fixed-value of anode-cathode voltage

a) PUT

b) SCR

c) **SUS**

d) BJT

51. The SCS is a four layer, four terminal thyristor. Can be turned on by

a) The anode gate

b) the cathode gate

c) **either of the gates**

d) gating both the gates together

3. Turn ON & Turn OFF Method of Thyristors

Position in Question Paper **Total Marks-28**

Q.1. b) 2-Marks.
Q.1. c) 2-Marks
Q.2. c) 4-Marks
Q.3. c) 4-Marks
Q.4. e) 4-Marks.
Q.5. b) 6-Marks.
Q.6. c) 6-Marks.

Descriptive Question

1. State difference between forced commutation and natural commutation.
2. State different trigger methods and describe R-triggering method for SCR with circuit diagram and waveforms.
3. Explain dv/dt turn on method of SCR.
4. Draw the layer diagram of PUT. With neat circuit diagram, describe its Working as relaxation oscillator
5. Describe the working of class B commutation with neat circuit diagram.
6. Explain class C commutation with circuit diagram.
7. Compare R-triggering and RC-triggering of SCR on the basis of (i) circuit Diagram, (ii) firing angle, (iii) cost, (iv) average output voltage.
8. List different turn-on methods of SCR
9. Draw and explain the VI characteristics of DIAC.
10. Explain SCR triggering using UJT with neat circuit diagram.
11. Draw the neat block diagram of gate triggering. State the advantages of gate Triggering.
12. Describe the operation of pulse transformer used in triggering circuits.
13. Explain RC triggering circuit with neat circuit diagram & waveforms.
14. Define commutation. List various types of commutation.
15. List any four methods of triggering of SCR.
16. Explain resonant commutation with necessary waveforms.

MCQ Question

(Total number of Question=Marks*3=14*3=42)

Note: Correct answer is marked with **bold**

1. The time constant of a series RC circuit (τ) is given by
   a) R/C
   b) C/R
   c) **RC**
   d) 1/RC
2. The time constant of a series RL circuit (τ) is given by
   a) **R/L**
   b) L/R
   c) RC
   d) 1/RL
3. In a single pulse semi-converter using two SCRs, the triggering circuit must produce
   a) two firing pulses in each half cycle
   b) **one firing pulse in each half cycle**
   c) three firing pulses in each cycle
   d) one firing pulse in each cycle
4. In a 3-phase full converter using six SCRs, gating circuit must provide
   a) one firing pulse every 30°
   b) one firing pulse every 90°
   c) **one firing pulse every 60°**
   d) three firing pulses per cycle
5. In the complete firing circuit, the driver circuit consists of
   a) pulse generator & power supply
   b) gate leads & power supply
   c) **pulse amplifier & pulse transformer**
   d) pulse detector & pulse amplifier
6. The magnitude of gate voltage and gate current for triggering an SCR is
   a) **inversely proportional to the temperature**
   b) directly proportional to the temperature
   c) inversely proportional to the anode current requirement
   d) directly proportional to the anode current requirement
7. Find the triggering frequency when the average gate power dissipation = 0.3 W and the peak gate drive power is 5 Watts. The gate source has a pulse width of 20 μsec duration.
   a) **3 kHz**
   b) 0.3 kHz
   c) 30 kHz
   d) 0.03 mHz
8. The major function of the pulse transformer is to
   a) Increase the voltage amplitude
   b) reduce harmonics
   c) **isolate low & high power circuit**
   d) create periodic pulses
9. In a resistance firing circuit the firing angle
   a) Cannot be greater than 120°
   b) **cannot be greater than 90°**
   c) cannot be greater than 180°
   d) cannot be greater than 160°

10. The diode in the R firing circuit
    a) ensures that the gate voltage is a half wave DC pulse
    b) **ensures that the gate voltage is a full wave DC pulse**
    c) ensures that the gate voltage is a half wave AC pulse
    d) ensures that the gate voltage is a full wave AC pulse
11. For a R firing circuit, the maximum value of source voltage is 100 V. Find the resistance to be inserted to limit the gate current to 2 A.
    a) 5 Ω
    b) **50 Ω**
    c) 500 Ω
    d) 0.5 Ω
12. In case of an RC half wave triggering circuit, the firing angle can be ideally varied between
    a) **0 to 180**
    b) 0 to 90
    c) 0 to 120
    d) 0 to 360
13. In case of a R firing circuit with $V_{gp} > V_{gt}$
    a) $\alpha = 90°$
    b) $\alpha > 90°$
    c) **$\alpha < 90°$**
    d) $\alpha = 0°$
14. In case of an RC full wave firing circuit with R load, the voltage across the load is zero for_____
    a) $\omega t = 0$ to α and $\omega t = \pi$ to $2\pi+\alpha$
    b) **$\omega t = 0$ to α**
    c) $\omega t = \pi$ to $2\pi+\alpha$
    d) $\omega t = \alpha$ to 2π
15. For an RC full wave firing circuit the empirical formula for calculating the value of RC is
    a) **RC = 157/ω**
    b) RC = 157 x ω
    c) RC = ω/157
    d) RC = 157 x ω^2
16. Pulse triggering can be only used by the _____ type of triggering circuit
    a) R
    b) RC
    c) **UJT**
    d) RLC
17. The UJT terminals are
    a) **E, B1 and B2**
    b) E1, E2 and B
    c) E, G and C
    d) G, S and D
18. In case of the UJT firing circuit, when the UJT turns on
    a) the capacitor starts to charge
    b) **the capacitor starts to discharge**
    c) the capacitor remains unaffected
    d) there is no capacitor in a UJT firing circuit
19. In the UJT firing circuit, the pulses are generated while the
    a) capacitor charges
    b) **capacitor discharges**
    c) capacitor voltage is zero
    d) there is no capacitor in a UJT firing circuit

20. Find the value of the charging resistor in case of a UJT firing circuit with firing frequency of 2 kHz, C = 0.04 μF, η = 0.72
a) 5.62 kΩ
b) 37 kΩ
c) 4.23 kΩ
d) **9.82 kΩ**

21. If the RC firing circuit used for firing an SCR is to be used to fire a TRIAC then
a) the capacitor should be removed
b) **the diode should be replaced by a Diac**
c) the diode should be replaced by a BJT
d) the diode should be shorted using a resistor

22. In the thyristor gating circuit, the supply to the pulse amplifier is provided by the
a) zcd
b) **isolation transformer**
c) synchronizing transformer
d) control signal generator

23. In the thyristor gating circuit, the ZCD is used to
a) amplify the voltage
b) produce a train of pulses
c) **convert AC input the ramp voltage**
d) used to step-down the voltage

24. The firing-angle delay is
a) inversely proportional to the synchronizing transformer voltage
b) inversely proportional to the control signal voltage
c) directly proportional to the synchronizing transformer voltage
d) **directly proportional to the control signal voltage**

25. The pulse gating is not suitable of
a) R loads
b) RC loads
c) **RL loads**
d) It is suitable of every type of load

26. In case of a cosine firing scheme, _____ is used to get a cosine wave
a) IC 555
b) a comparator
c) **an integrator circuit**
d) a differentiator circuit

27. If the gating circuits generator negative pulses, then those can be removed by using
a) schmit triggers
b) **clippers**
c) clampers
d) zener diodes

28. The improved version of the UJT oscillator triggering circuit is the
a) **Ramp & pedal triggering**
b) RC triggering
c) cosine-pulse triggering
d) ramp triggering

29. The decaying factor in the wave shape of the output pulses from the pulse transformer is its
a) Transformer ratio
b) **inductance**
c) capacitance
d) resistance

30. The thyristor turn-off requires that the anode current
    a) **falls below the holding current**
    b) falls below the latching current
    c) rises above the holding current
    d) rises above the latching current
31. In case of class A type commutation or load commutation with low value of R load the
    a) L is connected across R
    b) L-C is connected across R
    c) L is connected in series with R
    d**) L-C is connected in series with R**
32. The class A commutation or load commutation is possible in case of
    a) **dc circuits only**
    b) ac circuits only
    c) both DC and AC circuits
    d) none of the above mentioned
33. In case of class B commutation or resonant-pulse commutation with L = 5 μH and C = 20 μC with initial voltage across the capacitor (Vs) = 230 V. Find the peak value of resonant current.
    a) 560 A
    b) **460 A**
    c) 360 A
    d) 260 A
34. In case of class B commutation or resonant-pulse commutation with L = 5 μH and C = 20 μC with the initial voltage across the capacitor (Vs) = 230 V. Find the conduction time for auxiliary thyristor.
    a) 0.23 μs
    b) 6.57 μ
    c) **31.41 μs**
    d) 56 μs
35. The type of commutation when the load is commutated by transferring its load current to another incoming thyristor is
    a) class A or load commutation
    b) class B or resonant commutation
    c) **class C or complementary commutation**
    d) class D or impulse commutation
36. The type of commutation in which the pulse to turn off the SCR is obtained by separate voltage source is
    a) Class B commutation
    b) class C commutation
    c) class D commutation
    d) **class E commutation**
37. The natural reversal of ac supply voltage commutates the SCR in case of
    a) forced commutation
    b) only line commutation
    c) only natural commutation
    d) **both line & natural commutation**
38. _____commutation technique is commonly employed in series inverters.
    a) Line
    b) **load**
    c) forced
    d) external-pulse

39. Natural commutation of an SCR takes place when
a) voltage across the device becomes negative
b) voltage across the device becomes positive
c) gate current becomes zero
d) **anode current becomes zero**

40._____ commutation is usually used in phase-controlled rectifiers
a) **Line**
b) load
c) forced
d) external-pulse

41.Parallel-capacitor commutation is
a) Line commutation
b) load commutation
c) **forced commutation**
d) external-pulse commutation

42.Class E commutation is a/an
a) line commutation technique
b) load commutation technique
c) forced commutation technique
d) **external-pulse commutation technique**

4. Phase Control Rectifiers

Position in Question Paper **Total Marks-22**

Q.1. e) 2-Marks
Q.2. d) 4-Marks.
Q.4. a) 4-Marks
Q.5. a) 6-Marks.
Q.6. b) 6-Marks.

Descriptive Question

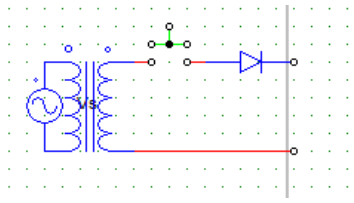
1. Define firing angle and conduction angle.
2. What is the polyphase rectifier? State its need
3. Draw the single phase full wave bridge type controlled rectifier. Draw the Waveforms of input voltage, load voltage and voltage across SCR
4. Compare controlled and uncontrolled rectifiers.
5. Describe the effect of freewheeling diode in controlled rectifier.
6. Draw circuit diagram of single phase half bridge inverter. Explain its working with output voltage waveforms.
7. Draw 1phase HWCR with inductive load. Draw input and output waveforms. Describe its operation.
8. Draw the circuit diagram input-output waveforms and explain the working of Single phase half wave controlled rectifier with R load.
9. Draw the neat circuit diagram and waveforms of single phase center tapped Full wave controlled rectifier with RL load.
10. Define firing angle and conduction angle. What is the effect of firing angle on Average output voltage?

MCQ Question

(Total number of Question=Marks*3=18*3=54)

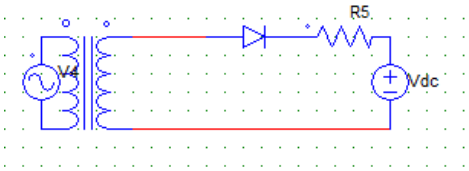
Note: Correct answer is marked with **bold.**

1. In a half-wave rectifier, the
   a) current & voltage both are bi-directional
   b) current & voltage both are uni-directional
   c) **current is always uni-directional but the voltage can be bi-directional or uni-directional**
   d) current can be bi-directional or uni-directional but the voltage is always uni-directional
2. For a single phase half wave rectifier, with R load, the diode is reversed biased from ωt
   a) 0 to π, 2π to 2π/3
   b) **π to 2π, 2π/3 to 3π**
   c) π to 2π, 2π to 2π/3
   d) 0 to π, π to 2π
3. In a 1-Phase HW diode rectifier with R load, the average value of load current is given by Take Input (Vs) = Vm sinωt
   a) Vm/R
   b) Vm/2R
   c) **Vm/πR**
   d) Zero
4. Find the average value of output current for a 1-phase HW diode rectifier with R load, having RMS output current = 100A.
   a) 200R A
   b) 100/R√2 A
   c) 200/R√2 A
   d) **200/Rπ A**
5. A 1-phase 230V, 1KW heater is connected across a 1-phase HW rectifier (diode based). The power delivered to the heater is
   a) 300 W
   b) 400 W
   c) **500 W**
   d) 600 W
6. A 1-phase half wave diode rectifier with R load, has input voltage of 240 V. The input power factor is
   a) Unity
   b) 0.707 lag
   c) **0.56 lag**
   d) 0.865 lag
7. A 1-phase half wave diode rectifier with R = 1 KΩ, has input voltage of 240 V. The diode peak current is
   a) Zero
   b) **240mA**
   c) 24mA
   d) 0.24mA
8. For the below given circuit, after the switch is closed the voltage across the load (shown open) remains constant.



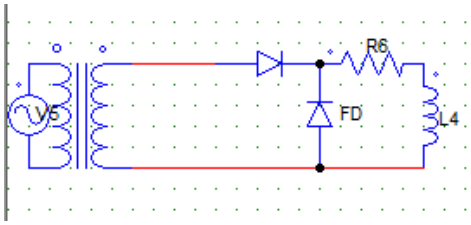
   Assuming that all initial conditions are zero. The element across the load would be a/an
   a) resistor
   b) **capacitor**
   c) inductor
   d) data not sufficient

9. For the below given circuit,



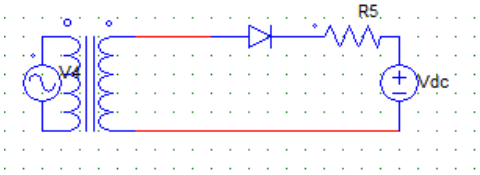
After the supply voltage (Vs) is given the
a) diode starts conducting
b) **diode starts conducting only when Vs exceeds Vdc**
c) diode never conducts
d) diode stops conducting only when Vs exceeds Vdc

10. For the below given circuit,



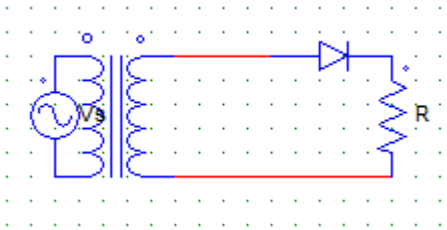
With Vs = Vm sin ωt (secondary side). The expression for the average voltage is
a) Vm
b) Vm/2π
c) **Vm/π**
d) Vm/2

11. For the below given circuit, the



12. a) output voltage is never positive
b) output current is never positive
c) output current is never zero
d) **output voltage is never zero**

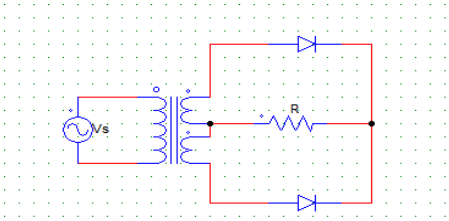
13. For the below given circuit,



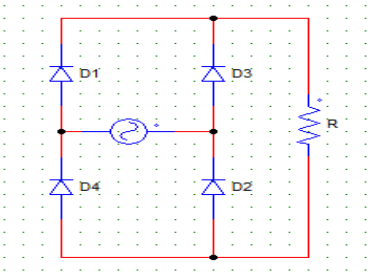
Vs = 325 sin ωt (secondary side) The ripple voltage is
a) **125.32 V**
b) 255.65 V
c) 325 V
d) 459.12 V

14. For a single phase half wave rectifier, the rectifier efficiency is always constant & it is
a) $\mathbf{4/\pi^2}$
b) $8/\pi^2$
c) 100
d) $2/\pi^2$

15. A single-phase full wave mid-point type diode rectifier requires _____ number of diodes whereas bridge type requires _____
    a) 1,2
    b) **2,4**
    c) 4,8
    d) 3,2
16. A single-phase full wave rectifier is a
    a) single pulse rectifier
    b) multiple pulse rectifier
    c) **two pulse rectifier**
    d) three pulse rectifier
17. The below shown circuit is that of a

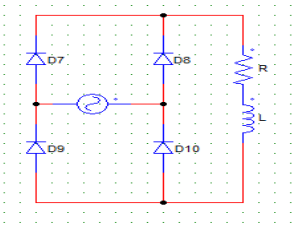


    a) full wave B-2 type connection
    b) **full wave M-2 type connection**
    c) half wave B-2 type connection
    d) half wave M-2 type connection
18. In a 1-phase full wave bridge rectifier with M-2 type of connection has secondary side voltage Vs = Vm sin ωt, with R load & ideal diodes.
    The expression for the average value of the output voltage can be given by
    a) **2Vm/π**
    b) Vm/π
    c) Vm/√2
    d) 2Vm/√2
19. The below shown circuit is that of a

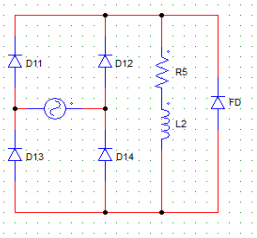


    a) full wave B-2 type connection
    b) full wave M-2 type connection
    c) **half wave B-2 type connection**
    d) half wave B-2 type connection
20. In a 1-phase full wave bridge rectifier with M-2 type of connection has secondary side voltage Vs = Vm sin ωt, with R load & ideal diodes.
    The expression for the rms value of the output voltage can be given by
    a) Vm/π
    b) **Vm/√2**
    c) Vm
    d) Vm^2
21. The PIV experienced by the diodes in the mid-point type configuration is
    a) Vm
    b) **2Vm**
    c) 4Vm
    d) Vm/2

22. For a single phase, full bridge, diode rectifier excited from a 230 V, 50 Hz source. With R = 10 Ω & the inductance(L) large enough to maintain continues conduction, the average and rms values of diode currents will be
    a) 7.85 A, 8 A
    b) 10.35 A, 7.85 A
    c) **10.35 A, 14.6 A**
    d) 8 A, 8 A
23. For the circuit shown below, the load current attains the maximum value at ωt =



    a) 0
    b) **π**
    c) 2π
    d) none of the mentioned
24. For a single phase, full bridge, diode rectifier excited from a 230 V, 50 Hz source. With R = 10 Ω & the inductance(L) large enough to maintain continuous conduction, the value of the supply power factor will be
    a) 0.707 lag
    b) 0.9 lag
    c) **0.86 lag**
    d) Unity
25. The rectification efficiency for B-2 type & M-2 type full wave diode rectifiers are ___ & ___ respectively.
    a) 8/π & 4/π
    b) 4/π & 8/π
    c) **8/π & 8/π**
    d) 4/π & 4/π
26. A load of R = 60 Ω is fed from 1phase, 230 V, 50 Hz supply through a step-up transformer & than a diode. The transformer turns ratio = 2. The power delivered to the load is
    a) 614 Watts
    b) **714 Watts**
    c) 814 Watts
    d) 914 Watts
27. For the circuit shown below, D11 & D14 conduct from?



    Assume that anode of D12 is positive at ωt = 0 and likewise.
    a) 0 to π
    b) **π to 2π**
    c) 2π to 3π
    d) 0 to π/2
28. In a single pulse semi-converter using two SCRs, the triggering circuit must produce
    a) two firing pulses in each half cycle
    b) **one firing pulse in each half cycle**
    c) three firing pulses in each cycle
    d) one firing pulse in each cycle

29. In a 3-phase full converter using six SCRs, gating circuit must provide
    a) one firing pulse every 30°
    c) **one firing pulse every 60°**
    b) one firing pulse every 90°
    d) three firing pulses per cycle
30. In the complete firing circuit, the driver circuit consists of
    a) pulse generator & power supply
    b) gate leads & power supply
    c) **pulse amplifier & pulse transformer**
    d) pulse detector & pulse amplifier
31. Find the average gate power dissipation (P_{gav}) when the maximum allowable gate power dissipation (P_{gm}) = 10 kW, with a duty cycle = 50 %.
    a) 10 KW
    c) 2.5 KW
    b) **5 KW**
    d) 7 KW
32. The magnitude of gate voltage and gate current for triggering an SCR is
    a) **inversely proportional to the temperature**
    b) directly proportional to the temperature
    c) inversely proportional to the anode current requirement
    d) directly proportional to the anode current requirement
33. Find the amplitude of the gate current pulse, when the gate-cathode curve is given by the relation Vg = [(1+10) x Ig] The peak gate drive power is 5 Watts.
    a) 359mA
    c) 1.359 A
    b) **659mA**
    d) 1.659 A
34. Find the triggering frequency when the average gate power dissipation = 0.3 W and the peak gate drive power is 5 Watts. The gate source has a pulse width of 20 μsec duration.
    a) **3 kHz**
    c) 30 kHz
    b) 0.3 kHz
    d) 0.03 mHz
35. The duty cycle can be written as
    a) **f x T**
    c) T/f
    b) f/T
    d) f
36. The major function of the pulse transformer is to
    a) Increase the voltage amplitude
    c) **isolate low & high power circuit**
    b) reduce harmonics
    d) create periodic pulses
37. In a resistance firing circuit the firing angle
    a) Cannot be greater than 120°
    c) cannot be greater than 180°
    b) **cannot be greater than 90°**
    d) cannot be greater than 160°
38. For a R firing circuit, the maximum value of source voltage is 100 V. Find the resistance to be inserted to limit the gate current to 2 A.
    a) 5 Ω
    c) 500 Ω
    b) **50 Ω**
    d) 0.5 Ω
39. The diode in the R firing circuit
    a) ensures that the gate voltage is a half wave DC pulse
    b) **ensures that the gate voltage is a full wave DC pulse**

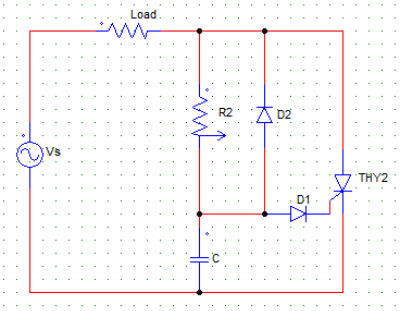
c) ensures that the gate voltage is a half wave AC pulse
d) ensures that the gate voltage is a full wave AC pulse

40. In case of an RC half wave triggering circuit, the firing angle can be ideally varied between
a) **0 to 180**
b) 0 to 90
c) 0 to 120
d) 0 to 360

41. In case of a R firing with R2 as the variable resistance, V_{gp} (peak of gate voltage) and V_{gt} (gate triggering voltage) the value of R2 is so adjusted such that
a) **$V_{gp} = V_{gt}$**
b) $V_{gp} > V_{gt}$
c) $V_{gp} < V_{gt}$
d) $V_{gp} = V_{gt} = 0$

42. In case of a R firing circuit with $V_{gp} > V_{gt}$
a) $\alpha = 90°$
b) $\alpha > 90°$
c) **$\alpha < 90°$**
d) $\alpha = 0°$

43. The figure shown below is that of a



a) R firing circuit
b) **RC half-wave firing circuit**
c) RC full-wave firing circuit
d) UJT triggering circuit

44. In case of an RC full wave firing circuit with R load, the voltage across the load is zero for_____
a) $\omega t = 0$ to α and $\omega t = \pi$ to $2\pi+\alpha$
b) **$\omega t = 0$ to α**
c) $\omega t = \pi$ to $2\pi+\alpha$
d) $\omega t = \alpha$ to 2π

45. Choose the incorrect statement with respect to the use of FD in half-wave circuits.
a) Input pf is improved
b) Load current waveform is improved
c) **It prevents the load voltage from becoming negative**
d) Reduces the reverse voltage (PIV) faced by the SCR

46. By using a freewheeling diode (FD) in a rectifier with RL load, the power consumed by the load
a) **Increases**
b) decreases
c) is not affected
d) decreases to zero

47. The average output voltage is maximum when SCR is triggered at $\omega t =$
a) π
b) **0**
c) $\pi/2$
d) $\pi/4$

48. In the method of phase control, the phase relationship between ___ & ___ is controlled by varying the firing angle
    a) supply current, supply voltage
    b) end of the load current, end of the load voltage
    c) **start of the load current, start of the load voltage**
    d) load current, load voltage
49. In a single phase half-wave thyristor circuit with R load & Vs=Vm sinωt, the maximum value of the load current can be given by
    a) 2Vm/R
    b) Vs/R
    c) **Vm/2**
    d) Vs/2
50. For a single phase thyristor circuit with R load & firing angle α, the conduction angle can be given by
    a) π+α
    b) 2π+α
    c) **π-α**
    d) α
51. For a single phase half-wave thyristor circuit with R load, the power delivered to the resistive load is
    a) (average load voltage) x (average load current)
    b) (rms supply voltage)^2/R
    c) **(rms load voltage)^2/R**
    d) (average load voltage)/R
52. For a single phase half-wave thyristor circuit with R load, the input power factor is given by
    a) rms source voltage/total rms line current
    b) rms input power/power delivered to the load
    c) cos α
    d) **power delivered to load/input VA**
53. In case of a single-phase half-wave circuit with RL load, with firing angle α and extinction angle β, the conduction angle γ can be written as
    a) γ = β+α
    b) **γ = β-α**
    c) γ = β/α
    d) γ = α/β
54. In case of a single-phase half-wave circuit with RL load, with firing angle α and extinction angle β, the thyristor is reversed biased from
    a) β to α
    b) β to 2π+α
    c) **β to 2π**
    d) β to 2β

5. Industrial Control Circuits

Position in Question Paper **Total Marks-16**

Q.1. g) 2-Marks
Q.3. a) 4-Marks.
Q.4. c) 4-Marks
Q.6. a) 6-Marks.

Descriptive Question

1. List two applications of Inverter.
2. Draw labelled basic block diagram of UPS
3. Draw the neat circuit diagram of fan speed regulator using Triac.Describe its working.
4. State the function of SMPS. Sketch block diagram of SMPS and label it well.
5. State the need of Inverter. List four applications of Inverters
6. Draw the circuit diagram of light dimmer using DIAC and TRIAC and sketch The input and output voltage waveforms.
7. Draw labelled circuit diagram of battery charger using SCR
8. Draw circuit diagram and explain the working emergency light system using SCR.
9. Draw the circuit diagram of temperature controller using SCR with neat Circuit diagram.
10. Draw and explain the diagram of electronic timer using SCR.
11. Draw and explain on-line UPS.

MCQ Question

(Total number of Question=Marks*3=15*3=45)

Note: Correct answer is marked with **bold.**

1. AC voltage controllers convert
   a) Fixed ac to fixed dc
   b) variable ac to variable dc
   c) **fixed ac to variable ac**
   d) variable ac to fixed ac
2. In AC voltage controllers the
   a) variable ac with fixed frequency is obtained
   b) variable ac with variable frequency is obtained
   c) **variable dc with fixed frequency is obtained**
   d) variable dc with variable frequency is obtained
3. Earlier then the semiconductor technology, _____ devices were used for voltage control applications.
   a) Cycloconverters
   b) vacuum tubes
   c) **tap changing transformer**
   d) induction machine
4. The AC voltage controllers are used in _____ applications.
   a) Power generation
   b) **electric heating**
   c) conveyor belt motion
   d) power transmission
5. In the principle of phase control
   a) the load is on for some cycles and off for some cycles
   b) **control is achieved by adjusting the firing angle of the devices**
   c) control is achieved by adjusting the number of on off cycles
   d) control cannot be achieved
6. SMPS is used for
   a) obtaining controlled ac power supply
   b) **obtaining controlled dc power supply**
   c) storage of dc power
   d) switch from one source to another
7. SPMS are based on the _____ principle.
   a) Phase control
   b) Integral control
   c**) Chopper**
   d) MOSFET
8. Choose the incorrect statement.
   a) SMPS is less sensitive to input voltage variations
   b) SMPS is smaller as compared to rectifiers
   c) **SMPS has low input ripple**
   d) SMPS is a source of radio interference

9.____ is used for critical loads where temporary power failure can cause a great deal of inconvenience.
a) SMPS
b) **UPS**
c) MPS
d) RCCB

10.___ is used in the rotating type UPS system to supply the mains.
a) DC motor
b) Self excited DC generator
c) **Alternator**
d) Battery bank

11. Static UPS requires _____
a) Only rectifier
b) only inverter
c) **both inverter and rectifier**
d) none of the mentioned

12. No discontinuity is observed in case of
a) short break static UPS configuration
b) long break static UPS configuration
c) **no break static UPS configuration**
d) rotating type UPS configuration

13. Usually _____ batteries are used in the UPS systems.
a) NC
b) Li-On
c) **Lead acid**
d) All of the mentioned

14. HVDC transmission has _____ as compared to HVAC transmission.
a) Smaller transformer size
b) **smaller conductor size**
c) higher corona loss
d) smaller power transfer capabilities

15. The negative polarity is used in the monopolar link because it
a) uses less conductor size
b) is safer
c) **produces less radio interference**
d) has less resistance

16 .HVDC transmission lines are _____ as compared to HVAC lines.
a) difficult to erect
b) more expensive for long distances
c) **more expensive for short distances**
d) less expensive for short distances

17. In HVDC transmission lines
a) both the stations operate as an inverter
b) both the stations operate as a converter
c) **one acts as a converter and other as an inverter**
d) depends upon the type of the load

18. For high power applications _____ are used as static switches whereas for low power applications _____ are used.
    a) **Transistors, SCRs**
    b) SCRs, transistors
    c) Diodes, transistors
    d) SCRs, diodes
19. _____ can be used as a single phase static ac switch.
    a) Diode
    b) SCR
    c) DIAC
    d) **TRAIC**
20. _____ can be used as a dc static switch.
    a) GTO
    b) Transistor
    c) Both GTO and transistor
    d) **TRIAC**
21. A single-phase ac switch is used in between a 230 V source and load of 2 kW and 0.8 lagging power factor. Determine the rms current rating required by the SCR. Use the factor of safety = 2.
    a) 10.87 A
    b) 87 A
    c) **21.74 A**
    d) 32 A
22. Solid State Relays (SSRs) have
    a) Moving parts
    b) **no moving parts**
    c) a coil
    d) a contactor
23. Induction heating is a _____ type of heating
    a) Zero frequency
    b) high frequency
    c) **power frequency**
    d) none of the mentioned
24. The factors governing the induction heating are
    a) Resistivity
    b) relative permeability
    c) magnetic field intensity
    d) **all of the mentioned**
25. TRIAC is used in
    a) chopper
    b) speed control of induction machine
    c) **speed control of universal motor**
    d) none of the mentioned
26. The ratio V_{rms}/ V_{dc} is known as
    a) **Form factor**
    b) ripple factor
    c) Utilization factor
    d) None of the mentioned
27. Determine the loss in the Snubber circuit, if C = 0.545 μF and supply is 200 V, 10 kHz.
    a) 233 W
    b) **133 W**
    c) 333 W
    d) 233 W
28. Ionization in circuit breakers is facilitated by
    a) Increase of field strength
    b) Increase of mean free path
    c) High temperature
    d) **All of these**

29. The negative polarity is used in the monopolar link because it
    a) uses less conductor size
    b) is safer
    c) **produces less radio interference**
    d) has less resistance
30. TRIAC is used in
    a) chopper
    b) speed control of induction machine
    c) **speed control of universal motor**
    d) none of the mentioned
31. SMPS is used for
    a) obtaining controlled ac power supply
    b) **obtaining controlled dc power supply**
    c) storage of dc power
    d) switch from one source to another
32. SPMS are based on the _____ principle.
    a) Phase control
    b) Integral control
    c**) Chopper**
    d) MOSFET
33. In HVDC transmission lines
    a) both the stations operate as an inverter
    b) both the stations operate as a converter
    c) **one acts as a converter and other as an inverter**
    d) depends upon the type of the load
34. For high power applications _____ are used as static switches whereas for low power applications _____ are used.
    a) **Transistors, SCRs**
    b) SCRs, transistors
    c) Diodes, transistors
    d) SCRs, diodes
35._____ can be used as a single phase static ac switch.
    a) Diode
    b) SCR
    c) DIAC
    d) **TRAIC**
36._____ can be used as a dc static switch.
    a) GTO
    b) Transistor
    c) Both GTO and transistor
    d) **TRIAC**
37. The anode current is ideally limited by the
    a) gate pulse amplitude
    b) internal impedance of the device
    c) **load Impedance**
    d) gate circuit impedance
38. Sequence control of ac voltage controllers is employed for the improvement of __
    a) output frequency
    b) input frequency
    c) commutation
    d) **system power factor**

39.In the reverse blocking mode the middle junction (J_2) has the characteristics of that of a

a) Transistor
b) **capacitor**
c) inductor
d) none of the mentioned

40. _ are semiconductor thyristor devices which can be turned-on by light of appropriate wavelengths.

a) LGTOs
b) LASERs
c) MASERs
d) **LASCRs**

41. The minimum value of anode current below which it must fall to completely turn-off the device is called as the

a) **Holding current value**
b) latching current value
c) switching current value
d) peak anode current value

42. The latching current is _____ than the holding current

a) Lower
b) **higher**
c) same as
d) negative of

43. For effective turning off of the SCR after the anode current has reached zero value,

a) chargers are injected by applying reverse anode-cathode voltage
b) **chargers are removed by applying reverse anode-cathode voltage**
c) chargers are injected by applying gate signal
d) chargers are removed by applying gate signa

44. To avoid commutation failure

a) **circuit turn-off time must be greater than the thyristor turn-off time**
b) circuit turn-off time must be lesser than the thyristor turn-off time
c) circuit turn-off time must be equal to the thyristor turn-off time
d) none of the above mentioned

45. The gate characteristics of thyristor is a plot of

a) V_g on the X-axis & I_g on the Y-axis
b) **I_g on the X-axis & V_g on the Y-axis**
c) V_a on the X-axis & I_g on the Y-axis
d) I_g on the X-axis & V_a on the Y-axis