

ELECTRICAL ENGINEERING

PAPER-II

1. When a thyristor is negatively biased
 - a. All the three junctions are negatively biased
 - b. Outer junctions are positively biased and the inner junction is negatively biased.
 - c. Outer junctions are negatively biased and the inner junction is positively biased
 - d. The junction near the anode is negatively biased and the one near the cathode is positively biased
2. Consider the following semiconductor devices:
 1. Triac
 2. Thyristor
 3. Amplifying gate thyristor.
 The correct sequence of these devices in increasing order of their di/dt capabilities is
 - a. 1, 3, 2
 - b. 1, 2, 3
 - c. 3, 1, 2
 - d. 3, 2, 1
3. In dc choppers feeding highly inductive loads, the waveforms for input and output currents are
 - a. Discontinuous and continuous respectively
 - b. Both continuous
 - c. Both discontinuous
 - d. Continuous and discontinuous respectively
4. A single-phase voltage source square-wave inverter feeds pure inductive load. The waveform of the load current will be
 - a. Sinusoidal
 - b. Rectangular
 - c. Trapezoidal
 - d. Triangular
5. In machine tool drive application, the speed of a separately excited dc motor is required to be controlled both below and above the rated speed of the motor. Which one of the following methods is best suited for this purpose? (V_a = armature voltage, I_f = field current and $I_{f\text{ rated}}$ = field current at rated speed)
 - a. $I_f = I_{f\text{ rated}} \cdot V_a$ variable
 - b. V_a fixed, I_f variable
 - c. V_a and I_f variable, with $I_f \leq I_{f\text{ rated}}$
 - d. V_a and I_f variable, with $I_f \geq I_{f\text{ rated}}$
6. A separately excited dc motor is required to be controlled from a 3-phase source for operation in the first quadrant only. The most preferred converter would be:
 - a. Fully controlled converter
 - b. Fully controlled converter with freewheeling diode
 - c. Half-controlled converter
 - d. Sequence control of two series connected fully controlled converters
7. If the commutation angle of a diode rectifier (due to source inductance effect) is μ , then the inductive voltage regulation will be
 - a. $\frac{1 + \cos \mu}{2}$
 - b. $1 + \frac{\cos \mu}{2}$
 - c. $1 - \frac{\cos \mu}{2}$
 - d. $\frac{1 - \cos \mu}{2}$
8. Consider the following statements:
 The diodes in a voltage source inverter (McMurray inverter) should be able to
 1. Withstand a large voltage in the reverse direction.
 2. Carry the commutating current excess of load current.
 3. Provide the required reverse bias to the outgoing thyristor.
 4. Feedback the reactive current to the source.

Of these statements

- 1, 2 and 3 are correct
- 1, 3 and 4 are correct
- 2, 3 and 4 are correct
- 1, 2 and 4 are correct

9. The ac-to-dc voltage ratio of a converter in the state of discontinuous conduction is

- Dependent upon the firing angle but independent of load time constant
- Dependent upon load time constant but independent of firing angle
- Dependent upon both firing angle and load time constant
- Independent of both firing angles and load time constant

10. In a 3-phase bridge rectifier fed from the star connected secondary winding of a transformer, let the voltage to the neutral of the A - phase (phase sequence A, B, C) be $V_m \sin \omega t$. At the instant when the voltage of A-phase is maximum, the output voltage at the rectifier terminals will be

- $V_m / \sqrt{2}$
- V_m
- $1.5 V_m$
- $\sqrt{3} V_m$

11. Consider the following statements regarding speed control of induction motors by means of external rotor resistors:

- Reduction in speed is accompanied by reduced efficiency
- With a large resistance in the rotor circuit, the speed would vary considerably with variation in torque.
- The method is very complicated.

The Disadvantages of such a method of speed control would include

- 1 and 2
- 2 and 3
- 1 and 3
- 1, 2 and 3

12. Consider the following statements:

Switched mode power supplies are preferred over the continuous types, because they are

- Suitable for use in both ac and dc.
- More efficient.

3. Suitable for low-power circuits.

4. Suitable for high-power circuits.

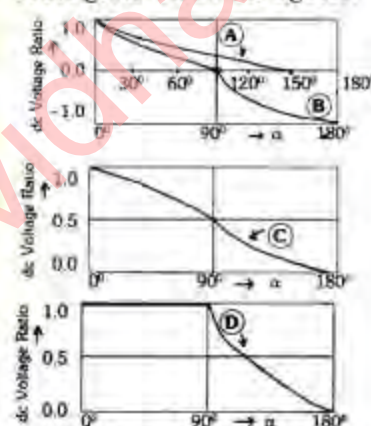
Of these statements

- 1 and 2 are correct
- 1 and 3 are correct
- 2 and 3 are correct
- 2 and 4 are correct

13. In dc choppers, per unit ripple is maximum when the duty cycle α is

- 0.2
- 0.5
- 0.7
- 0.9

14. Match the 3 curves labelled A, B, C and D with the characteristics given under list-II and select the correct answer using the codes given below the figures:



List II: Control characteristic of a

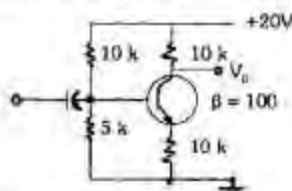
- 3-pulse converter feeding pure resistance
- Fully controlled converter feeding R-L load with perfect smoothing
- Single-phase ac voltage controller feeding pure inductive load
- 6-pulse half-controlled converted

	A	B	C	D
a.	1	2	3	4
b.	1	2	4	3
c.	2	1	3	4
d.	2	1	4	3

15. A 3-pulse converter feeds a pure resistive load at a firing angle of $\alpha = 60^\circ$. The average value of current flowing in the load is 10. If a very large inductance is connected in the load circuit, then the

- Average value of current will remain as 10 A

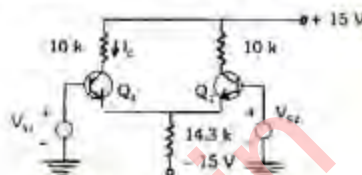
- b. Average value of current will become greater than 10A
 c. Average value of current will become less than 10 A
 d. Trend of variation of current cannot be predicted unless the exact value, of the inductance connected is known
16. In a 3-phase rectifier circuit, thyristor number 1,2 and 3 are connected respectively to R, Y and B phases of the star-connected transformer secondary. When the current is being commutated from thyristor No. 1 to No. 2 the effect of the transformer leakage and the ac system inductance will be such that it will
- a. Prolong the conduction in No. 1 and delay the turn-on of No. 2 correspondingly
 b. Stop the conduction in No. 1 at the scheduled time, but delay the turn-on of No.2
 c. Produce conduction in both No. 1 and No.2 in parallel for an overlapping period through a transient
 d. Double the voltage output through a commutation transient
17. If an intrinsic semiconductor is doped with a very small amount of boron, then in the extrinsic semiconductor so formed, the number of electrons and holes will
- a. Decrease
 b. Increase and decrease respectively
 c. Increase.
 d. Decrease and increase respectively
18. If $\alpha = 0.98$, $I_{C0} = 6\mu\text{A}$ and $I_B = 100\mu\text{A}$ for a transistor, then the value of I_C will be
- a. 2.3 mA
 b. 3.1 mA
 c. 4.6 mA
 d. 5.2 mA
19. The given figure shows a silicon transistor connected as a common emitter amplifier. The quiescent collector voltage of the circuit is approximately



- a. 20/3 V

- b. 10 V
 c. 14V
 d. 20V

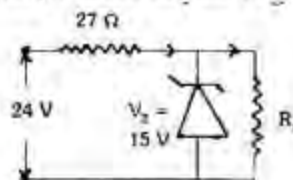
20. A difference amplifier is shown in the figure transistors Q_1 and Q_2 have identical parameters. Assuming that $V_{BE} = 0.7\text{ V}$ and $\beta = 200$ for each transistor and given that $V_{S1} = V_{S2} = V_{S2} = 0$, the value of the collector current I_C will be



- a. 2 mA
 b. 1 mA
 c. 0.5 mA
 d. 2.5 μA

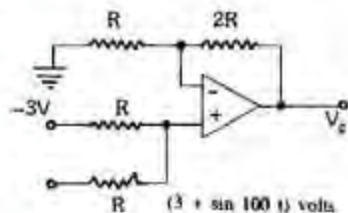
21. A junction transistor operating at room temperature with $I_C = 2\text{ mA}$ where $kT/q = 25\text{ mV}$ has $\beta = 100$. The values of the parameters g_m in mhos and r_e in ohms will be respectively
- a. 0.04 and 2500
 b. 0.08 and 1250
 c. 0.5 and 800
 d. 0.08 and 5000
22. An amplifier with mid-band gain $|A| = 500$ has negative feedback $|\beta| = \frac{1}{100}$. If the upper cut-off without feedback were at 60 kHz, then with feedback it would become
- a. 10 kHz
 b. 12 kHz
 c. 300 kHz
 d. 360 kHz

23. The circuit shown in the figure has a Zener regulated dc power supply. Assuming that the Zener diode is ideal, the MINIMUM value of R_L down to which the output voltage would remain constant is

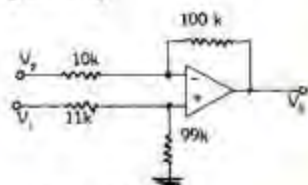


- a. 15 ohms
 b. 24 ohms
 c. 27 ohms

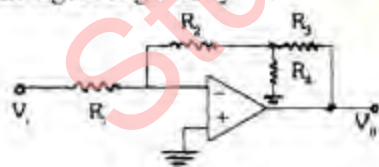
- d. 45 ohms
24. A non-inverting OP-AMP summer is shown in the figure. The output voltage V_o is



- a. $\sin 100t$
 b. $\frac{3}{2} \sin 100t$
 c. $2 \sin 100t$
 d. $3 \sin 100t$
25. The expression for the output voltage V_o in terms of the input voltages V_1 and V_2 in the circuit shown in the figure, assuming the operational amplifier to be ideal is;
 $V_o = A_1 V_1 + A_2 V_2$
 The values of A_1 and A_2 would be respectively



- a. 9 and -10
 b. 9.9 and -10
 c. -9 and 10
 d. -9.9 and 10
26. The transfer gain for the circuit shown in the figure is given by



- a. $-\left[\frac{R_2 + R_3 + \frac{R_2 R_3}{R_4}}{R_1} \right]$
 b. $-\left[\frac{\frac{R_2 R_3}{R_3 + R_4} + R_2}{R_1} \right]$

c. $-\left[\frac{\frac{R_2 R_4}{R_2 + R_4} + R_3}{R_1} \right]$

d. $-\left[\frac{R_2 + R_3}{R_1} \right]$

27. Consider the following statements regarding an RC phase-shift oscillator:

1. The amplifier gain is positive.
2. The amplifier gain is negative.
3. The phase shift introduced by the feedback network is 180° .
4. The phase shift introduced by the feedback network is 360° .

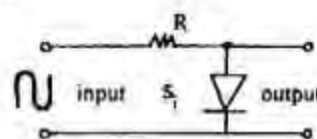
Of these statements

- a. 1 and 3 are correct
- b. 2 and 3 are correct
- c. 2 and 4 are correct
- d. 1 and 4 are correct

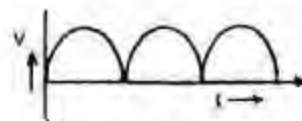
28. If an input signal with non-zero dc component is applied to a low pass RC network, the dc component in the output will be

- a. The same as that in the input
- b. Less than in the input
- c. More than that in the input
- d. Zero

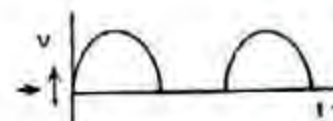
29. For the given input, the output waveform across the diode shown in the figure will be



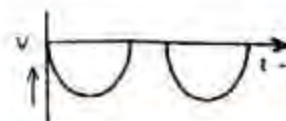
a.



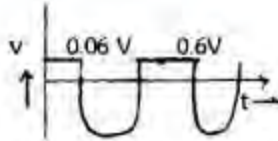
b.



c.



d.

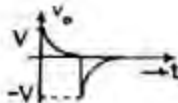


30. The waveform of the output of a low pass filter to a step input will be as in

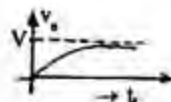
a.



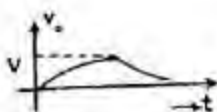
b.



c.



d.



31. The voltage levels for a negative logic system.

- Must necessarily be negative
- Could be negative or positive
- Must necessarily be positive
- Must necessarily be either zero or $-5V$

32. Which one of the following is the truth table of the given logic circuit?



a.

X	Y	Z
0	0	1
0	1	1
1	0	1
1	1	1

b.

X	Y	Z
0	0	0
0	1	1
1	0	1
1	1	1

c.

X	Y	Z
0	0	1
0	1	0
1	0	0
1	1	0

d.

X	Y	Z
0	0	0
0	1	1
1	0	1
1	1	0

33. In a half-adder having two inputs A and B and two outputs (S and C are the Sum and Carry output bits respectively), the Boolean expressions for S and C in terms of A and B is:

- $S = \bar{A}B + A\bar{B}; C = A.B$
- $S = AB + \bar{A}\bar{B}; C = A + B$
- $S = \bar{A}\bar{B} + AB; C = A + B$
- $S = \bar{A}B + A\bar{B}; C = \bar{A} + B$

34. A combinational circuit has inputs A, B and C and its Karnaugh Map is as shown. The output of the circuit is given by

AB	00	01	11	10
C				
0		1		1
1	1		1	

- $(\bar{A}B + A\bar{B})C$
- $(\bar{A}B + A\bar{B})\bar{C}$
- $\bar{A}\bar{B}\bar{C}$
- $A \oplus B \oplus C$

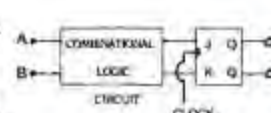
35. The output Q_n of a J-K flip-flop is zero. If changes to 1 when a clock pulse is applied. The inputs J_n and K_n are respectively

- 1 and X
- 0 and X
- X and 0
- X and 1

36. To realize the given truth table from the circuit shown in the figure, the input to J in terms of A and would have to be

Truth Table

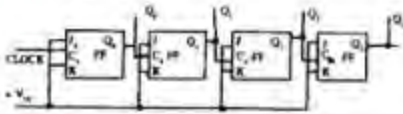
A	B	Q_{n+1}
0	0	Q_n
0	1	1
1	0	Q_n
1	1	0



- AB
- A

- c. B
d. AB

37. The circuit schematic shown in the following figure



Represents 4-bits

- a. Static shift register
b. Dynamic shift register
c. Asynchronous counter
d. Synchronous counter
38. Match List-I (Function/circuit) with list-II (circuit realization) and select the correct answer

List I

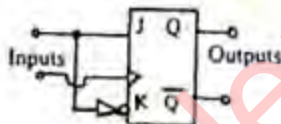
- A. D-flip flop
B. T-flip flop
C. Exclusive OR
D. Half adder

List II

1.



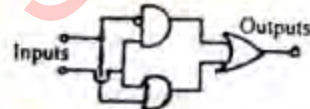
2.



3.



4.



- | | A | B | C | D |
|----|---|---|---|---|
| a. | 2 | 3 | 1 | 4 |
| b. | 2 | 3 | 4 | 1 |
| c. | 3 | 2 | 4 | 1 |
| d. | 3 | 2 | 1 | 4 |

39. The larger the RAM of a computer, the faster is its speed, since it eliminates
- a. Need for ROM
b. Need for external memory

- c. Frequent disk I/Os
d. Need for a data-wind path
40. DB, DW and DD directives are used to place data in particular locations or to simply allocate space without reassigning anything to space. The DW and DD directions are used to generate
- a. Offsets
b. Full address of variables
c. Full address of labels
d. Offsets or full address of labels and variables
41. Match List-I (Type of instruction) with list-II (Instruction) and select the correct answer

List I

- A. One byte instruction
B. Two bytes instruction
C. Three bytes instruction
D. Register indirect addressing

List II

1. MOV A, data
2. MOV A, B
3. MOV A, M
4. JMP addr.

- | | A | B | C | D |
|----|---|---|---|---|
| a. | 1 | 2 | 4 | 3 |
| b. | 2 | 1 | 4 | 3 |
| c. | 2 | 1 | 3 | 4 |
| d. | 1 | 2 | 3 | 4 |

42. Consider the following set of instructions:

STC
CMC
MOV A,B
RAL
MOV B,A

This set of instructions

- a. Doubles the number in Register B
b. Divides the number in Register by 2
c. Multiplies B by A
d. Adds A and B
43. The number bits needed to address 4K memory is
- a. 6
b. 8
c. 12
d. 16
44. The ESC instruction of 8086 may have two formats. In one of the formats, on

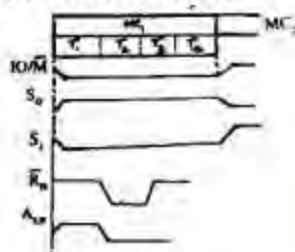
memory operand is used. Under this format, the number of external op-codes (for the co-processor) which can be specified is

- 64
- 128
- 256
- 512

45. The TRAP is one of the interrupts available in INTEL 8085. Which one of the following statements is true of TRAP?

- It is level triggered
- It is negative edge triggered
- It is positive edge triggered
- It is both positive edge triggered and level triggered

46. Consider the following figures showing clock periods of Instruction Fetch machine cycle for INTEL 8085.



An ERROR in the above diagram relates to the signal

- IO/M
- SO
- SI
- RD

47. In a 16-bit microprocessor, words are stored in two consecutive memory locations. The entire word can be read in one operation provided the first

- Word is even
- Word is odd
- Memory location is odd
- Memory address is even

48. A 3×8 decoder with two enable inputs is to be used to address 8 blocks of memory. What will be the size of each memory block when addressed from a sixteen bit bus with two MSBs used to enable the decoder?

- 2 K
- 4 K
- 16 K
- 64 K

49. A carrier signal of frequency f_c is modulated by a signal

$$2A \cos 2\pi f_1 t - A \sin 2\pi f_2 t$$

The spectrum of the modulated signal will include which of the following frequency components?

- $f_c + f_1 + f_2$
- $f_c - f_1 - f_2$
- $f_c + 2f_1 - f_2$
- $f_c - 2f_1 + f_2$

Select the correct answer using the codes given below:

- 1 and 2
- 3 and 4
- 3 alone
- 1, 2, 3 and 4

50. Which one of the following is the advantage of base modulation over collector modulation of a transistor Class C amplifier?

- Requires lower modulation power
- Higher power output per transistor
- Better efficiency
- Better linearity

51. In a narrow band FM system, the highest modulating frequency is f_m . The bandwidth of the system will be

- $6f_m$
- F_m
- $2f_m$
- $10f_m$

52. A telephone channel will PCM gives good performance at a transmission rate of 64k bits/s. With companding and complex version of delta modulation (DM), to achieve the same performance, the transmission rate must be close to

- 64 k bits/s
- 100 k bits/s
- 64 M bits/s
- 100 M bits/s

53. Equalizing pulses in TV are placed during the

- Vertical blanking period
- Horizontal blanking period
- Serrations
- Horizontal retrace

54. The most useful approach to radar system for monitoring the speed of moving vehicles is:
- Pulsed radar
 - Monopulse
 - Dopier radar
 - Auto-tracking radar
55. Consider the following statements:
The maximum range of radar can be increased by
- Increasing the peak transmitted power
 - Increasing the gain of the receiver
 - Increasing the diameter of the antenna
 - Reducing the wavelength used
- Of these statements
- 1,3 and 4 are correct
 - 1,2,3 and 4 are correct
 - 2 and 4 are correct
 - 1 and 3 are correct
56. Consider the following statements about broadband communications using submarine cables:
- A submarine cable repeater contains filters for the two directions of transmission.
 - Armoured submarine cable is used for the shallow- shore ends of the cable.
 - Fibre-optic submarine cable is used to prevent inadvertent plugging- in of the cable.
- Of these statements
- 1 and 2 are correct
 - 2 and 3 are correct
 - 1 and 3 are correct
 - 1, 2, and 3 are correct
57. To couple a coaxial line to a parallel wire line, it is best to use a
- Slotted line
 - Balun
 - Directional coupler
 - Quarter-wave transformer
58. Assertion A: A differentially compounded dc motor has the possibility of starting in the reversed direction.
Reason R: Owing to higher inductance in the series field, the resultant main flux reverses during starting.
- Both A and R are true and R is the correct explanation of A.
 - Both A and R are true but R is NOT a correct explanation of A
 - A is true but R is false
 - A is false but R is true
59. Assertion A: In a salient-pole synchronous motor, the angular displacement of rotor per unit change of power is less than that for a similar cylindrical rotor machine.
Reason R: A reluctance torque is developed in the salient- pole machine due to the effect of direct axis flux on the damper winding.
- Both A and R are true and R is the correct explanation of A.
 - Both A and R are true but R is NOT a correct explanation of A
 - A is true but R is false
 - A is false but R is true
60. Assertion A: During the load flow study, a voltage controlled bus is treated as a load bus when the magnitude of the voltage is very much higher or very much lower than the scheduled voltage.
Reason R: A tap changing transformer is represented as an net work in the load flow model.
- Both A and R are true and R is the correct explanation of A.
 - Both A and R are true but R is NOT a correct explanation of A
 - A is true but R is false
 - A is false but R is true
61. Assertion A: In the residual type earth compensation used in the distance protection schemes with solidly earthed neutral systems, the residual compensation circuit uses auxiliary current transformers.
Reason R: A fraction of the residual current is added to the fault current I_a for an earth fault on phase 'a'. This fraction is so chosen that the relay measures the positive sequence impedance Z_1 .
- Both A and R are true and R is the correct explanation of A.
 - Both A and R are true but R is NOT a correct explanation of A
 - A is true but R is false
 - A is false but R is true
62. Assertion A: In HVDC systems, the dc voltage should be as high as possible and

the rectifier control angle α should be as low as possible.

Reason R: Control of dc voltage is exercised by the rectifier and inverter control angles α and γ respectively.

- a. Both A and R are true and R is the correct explanation of A.
- b. Both A and R are true but R is NOT a correct explanation of A.
- c. A is true but R is false.
- d. A is false but R is true.

63. **Assertion A:** A 3-phase induction motor operation on a 3-phase voltage controller for speed control cannot be used for constant torque loads.

Reason R: The output voltage waveform of the controller is distorted.

- a. Both A and R are true and R is the correct explanation of A.
- b. Both A and R are true but R is NOT a correct explanation of A.
- c. A is true but R is false.
- d. A is false but R is true.

64. **Assertion A:** TTL and CMOS cannot be normally used together.

Reason R: TTL operates on a $(+5 \pm 0.25)$ V regulated supply voltage and some mA, while the CMOS operates on unregulated supply voltage of +3V to +15V and some μ A.

- a. Both A and R are true and R is the correct explanation of A.
- b. Both A and R are true but R is NOT a correct explanation of A.
- c. A is true but R is false.
- d. A is false but R is true.

65. **Assertion A:** Machine language program is written in hexadecimal.

Reason R: Microprocessor can understand hexadecimal number system.

- a. Both A and R are true and R is the correct explanation of A.
- b. Both A and R are true but R is NOT a correct explanation of A.
- c. A is true but R is false.
- d. A is false but R is true.

66. **Assertion A:** The degree of modulation of radio-frequency voltage present at the input terminals of the diode is less than the

degree of modulation of the original radio frequency signal in AM detector.

Reason R: It depends primarily on the ratio of the source impedance of the radio frequency voltage to the diode load impedance.

- a. Both A and R are true and R is the correct explanation of A.
- b. Both A and R are true but R is NOT a correct explanation of A.
- c. A is true but R is false.
- d. A is false but R is true.

67. **Assertion A:** The different components of a composite video signal are needed consecutively and not simultaneously at the TV receivers.

Reason R: The different components of the composite video signal are sent to the receiver on a frequency division basis.

- a. Both A and R are true and R is the correct explanation of A.
- b. Both A and R are true but R is NOT a correct explanation of A.
- c. A is true but R is false.
- d. A is false but R is true.

68. If the applied voltage of a certain transformer is increased by 50% and the frequency is reduced to 50% (assuming that the magnetic circuit remains unsaturated), the maximum core flux density will

- a. Change to three times the original value
- b. Change to 1.5 times the original value
- c. Change to 0.5 times the original value
- d. Remain the same as the original value

69. The low-voltage winding of a core-type transformer is subdivided into two equal halves, each of half the original width of the single winding with the high-voltage winding in between these two halves of low-voltage winding (instead of having usual construction of low-voltage winding adjacent to the core and surrounded by the high-voltage winding.) Such an interlacing of coils would make the combined primary and secondary leakage reactance (in terms of the primary) nearly

- a. Twice
- b. Equal
- c. Half
- d. One-fourth

70. Two 3-limb, 3-phase delta-star connected transformers are supplied from the same source. One of the transformers is of Dy 1 and the other is of Dy 11 connection. The phase difference between the corresponding phase voltages of the two second Aries would be

a. 0°
b. 30°
c. 60°
d. 120°

71. In a transformer fed from a fundamental frequency voltage source, the source of harmonics is the

a. Overload
b. Poor insulation
c. Iron loss
d. Saturation of core

72. A 40k VA transformer has a core loss of 400W and a full-load copper loss of 800 W. The proportion of full-load at maximum efficiency is

a. 50%
b. 62.3%
c. 70.7%
d. 100%

73. A single-phase transformer has a rating of 15 k VA, 600/120V. It is reconnected as an auto-transformer to supply at 720 V from a 600 V primary source. The maximum load it can supply is

a. 90 kVA
b. 18 kVA
c. 15 kVA
d. 12 kVA

74. The general expression for the instantaneous value of the torque of dynamo-electric machines is given by

$$T = \frac{1}{2} (i_1)^2 \frac{dL_1}{d\theta} + \frac{1}{2} (i_2)^2 \frac{dL_2}{d\theta} + i_1 i_2 \frac{dM}{d\theta}$$

Where i_1 and i_2 are rotor and stator currents respectively. L_1 and L_2 are rotor windings' self inductances.

M is the mutual inductance between stator and rotor windings and θ is the angular displacement of the rotor.

For a synchronous machine (cylindrical rotor), the torque is given by only the third term of the equation, because

- a. The average value of $(i_1)^2$ and $(i_2)^2$ each is zero

- b. The first and the second terms cancel each other

- c. $\frac{dL_1}{d\theta}$ and $\frac{dL_2}{d\theta}$ have opposite signs and

$$\frac{dL_1}{d\theta} = \frac{(i_2)^2}{(i_1)^2} \frac{dL_2}{d\theta}$$

- d. L_1 and L_2 do not vary with respect to θ

75. Match List-I (Parts of electrical machines) with List - II (The approximate nature of the air-gap mmf pattern produced by them) and select the correct answer

List I

- A. DC machine, stator
B. DC machine, rotor
C. Salient-pole synchronous machine, stator
D. Squirrel-cage rotor of induction motor

List II

1. Sinusoidal
2. Trapezoidal
3. Triangular

	A	B	C	D
a.	1	2	1	3
b.	3	1	3	1
c.	2	3	1	3
d.	2	3	1	1

76. A dc shunt generator, when driven at its rated speed, is found to be not generating any voltage. Which of the following would account for this?

1. There is no residual magnetism.
2. The connection of the field winding is not proper with respect to the armature terminals.
3. The resistance of the field circuit is greater than the critical field resistance.
4. The load resistance is less than the critical armature resistance.

Select the correct answer using the codes given below;

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

77. To have spark less commutation, the armature reaction effect in a dc machine is neutralized by

- Using compensating winding and commutating poles
- Shifting the brush axis from the geometrical neutral axis to the magnetic neutral axis
- Fixing the brush axis in line with the pole axis
- Increasing the field excitation

78. In a dc shunt generator working on load, the brushes are moved forward in the direction of rotation. As a result of this, commutation will

- Improve but terminal voltage will fall
- Worsen and terminal voltage will fall
- Improve and terminal voltage will rise
- Worsen and terminal voltage will rise

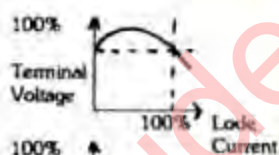
79. Match List-I (Ways of compounding series and shunt field windings of a dc compound generator) with list-II (Volt-ampere characteristics at constant speed) and select the correct answer using the codes given below the Lists:

List I

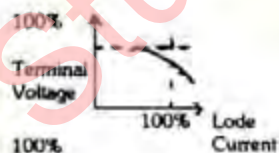
- Over compounded
- Level compounded
- Differentially compounded
- Under-compounded

List II

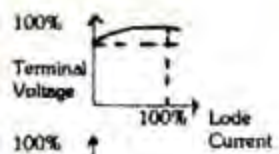
1.



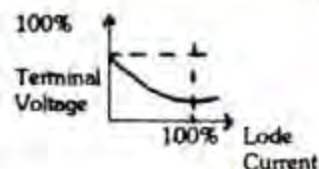
2.



3.



4.



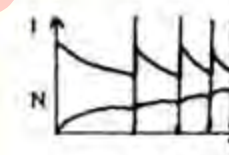
	A	B	C	D
a.	3	1	4	2
b.	3	1	2	4
c.	1	3	2	4
d.	1	3	4	2

80. Which one of the following figures best represents the variation in armature current and speed with time during the starting of a dc shunt motor?

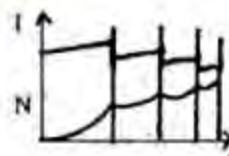
a.



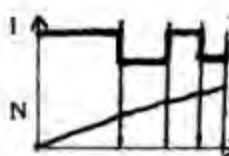
b.



c.



d.

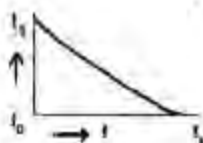


81. A dc over compounded generator was operating satisfactorily and supplying power to an infinite bus when the prime mover failed to supply any mechanical power. The machine would then run as a

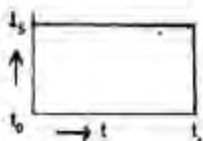
- Cumulatively compounded motor with speed reversed
- Cumulatively compounded motor with direction of rotation as before
- Differentially compounded motor with speed reversed
- Differentially compounded motor with direction of speed as before

82. A 3-phase alternator with high rotational inertia and negligible armature resistance was delivering power to an isolated load when the armature terminals got short-circuited. After a while, the mechanical power input to the shaft of the machine is terminated at time t_0 . The short-circuit current I_s circulating in the armature will vary till the machine comes to rest at time t_c . Which one of the curves shown in the following figures best reflects this variation?

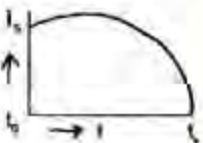
a.



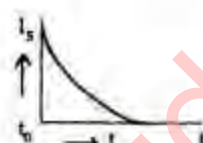
b.



c.



d.



83. When a synchronous motor is running at synchronous speed, the damper winding produces
- Damping torque
 - Eddy current torque
 - Torques aiding the developed torque
 - No torque

84. For a given developed power, a synchronous motor operating from a constant voltage and constant frequency supply, will draw the minimum and maximum armature currents, I_{min} and I_{max} respectively, corresponding to
- I_{min} at unity pf, but I_{max} at zero pf
 - I_{max} at unity pf, but I_{min} at zero pf
 - Both I_{min} and I_{max} at unity pf
 - Both I_{min} and I_{max} at zero pf

85. Match list-I (Type of winding) with list-II (Feature) and select the correct answer using the codes given below the Lists:

List I

- Fractional slot windings
- Chorded and distributed windings
- Damper windings
- Single-phase windings

List II

- Only two- third of the pole pitch is occupied by the winding
- Effects of slot harmonics are reduced or even eliminated
- The effects of phase belt harmonics are reduced
- Additional asynchronous torque capability in projected pole motors

	A	B	C	D
a.	2	3	4	1
b.	2	3	1	4
c.	3	2	1	4
d.	3	2	4	1

86. While conducting a 'slip' test for the determination of direct and quadrature-axis synchronous reactance's X_d and X_q of a salient pole synchronous machine, the rotor of the machine is run with a slip 's' and stator supply frequency 'f'. The frequency of

- Voltage induced across open field terminals,
 - Envelope of the armature terminal voltage,
 - Envelope of the armature current and
 - Armature current will be respectively
- sf , sf , sf and f
 - sf , f , sf and f
 - f , sf , f and sf
 - f , $(1-s)f$, $(2-s)f$ and sf

87. If two induction motors A and B are identical except that the air-gap of motor 'A' is 50% greater than that of motor 'B' then

- The no-load power factor of A will be better than that of B
- The no-load power factor of A will be poorer than that of B
- The core losses of A will be more than those of B
- The operating flux of A will be smaller than that of B

88. A 6-pole, 50Hz, 3-phase synchronous motor and an 8-pole, 50 Hz, 3-phase slip-ring induction motor are mechanically coupled and operate on the same 3-phase, 50 Hz supply system. If they are left open-circuited, then the frequency of the voltage produced across any two slip rings would be

a. 12.5 Hz
b. 25.0 Hz
c. 37.5 Hz
d. 50.0 Hz

89. Which of the following statements regarding skewing of motor bars in a squirrel-cage induction motor are correct?

1. It prevents cogging.
2. It produces more uniform torque.
3. It increases starting torque.
4. It reduces motor 'hum' during its operations

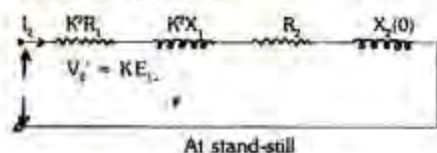
Select the correct answer using the codes given below:

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

90. The rotor power output of a 3-phase induction motor is 15kW and the corresponding slip is 4%. The rotor copper loss will be

a. 600 W
b. 625 W
c. 650 W
d. 700 W

91. For a more accurate analysis of the torque slip relation- ship, the equivalent circuit of a 3-phase induction motor for running condition is to be derived from the given stand-still condition:

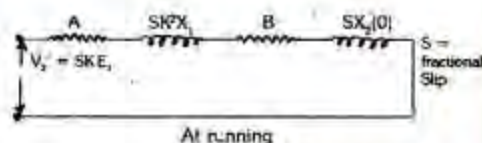


K_1 = ratio of transformation

$E_1 = V_1$ (applied voltage) - $I_1 \mu X_1$

$I_1 \mu$ = magnetizing current

At running condition, if the two resistances in the equivalent circuit are denoted by A and B, then



The values of A and B will be

a. $K^2 R_1$ and R_2
b. $SK^2 R_1$ and R_2
c. $K^2 R_1$ and SR_2
d. $SK^2 R_1$ and SR_2

92. A 3-phase wound rotor induction motor, when started with load connected to its shaft, was found to start but settle down at about half synchronous speed. If the rotor winding as well as the stator winding were star connected, then the cause of the malfunctioning could be attributed to

a. One of the stator phase windings being short-circuited
b. One of the supply fuses being blown
c. One of the rotor phases being open-circuited
d. Two of the rotor phases being open-circuited

93. Consider the following statements regarding fractional horse power shaded-pole motor:

1. Its direction of rotation is from unshaded to shaded portion of the poles.
2. Its direction of rotation is from shaded to unshaded portion of the poles.
3. It can remain stalled for short periods without any harm.
4. It has a very poor power factor.

Of these statements

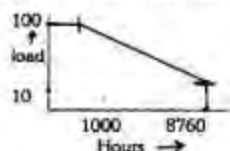
a. 1, 3 and 4 are correct
b. 2, 3 and 4 are correct
c. 2 and 4 are correct
d. 1 and 3 are correct

94. In the case of a converter- inverter speed control arrangement for an induction motor operating with $\frac{v}{f}$ constant and with negligible stator impedance

a. The maximum torque is independent of frequency
b. The maximum torque is proportional to frequency

- c. The slip at maximum torque is proportional to frequency
 d. The starting torque is proportional to frequency

95. The load curve of a system is shown in the figure. The load factor of the system is;



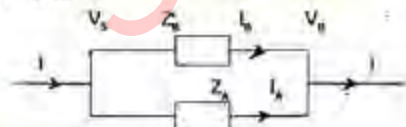
- a. 1.66%
 b. 6.013%
 c. 16.6%
 d. 60.13%
96. If the discharge is $1 \text{ m}^3/\text{s}$ and the head of water is 1, then the power generated by the alternator in one hour (assume 100% efficiency of the generator and turbine) will be

- a. 10 kW
 b. 73/75 kW
 c. 746/75 kW
 d. 100 kW

97. Control rods used in nuclear reactors are made of

- a. Zirconium
 b. Boron
 c. Beryllium
 d. Lead

98. Consider two parallel short transmission lines of impedances Z_A and Z_B respectively as shown in the figure. Currents I_A and I_B are both lagging and the sending-end voltage is V_s . If the reactance to resistance ratio of both the impedances Z_A and Z_B are equal then the total current 'I' will



- a. Lag both I_A and I_B
 b. Lead both I_A and I_B
 c. Lag one of I_A and I_B but lead the other
 d. Be in phase with both I_A and I_B
99. In a 3-core extra high voltage cable, a metallic screen around each core-insulation is provided to
- a. Facilitate heat dissipation
 b. Give mechanical strength

- c. Obtain radial electric stress
 d. Obtain longitudinal electric stress

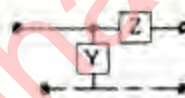
100. Galloping in transmission line conductors arises generally due to

- a. Asymmetrical layers of ice formation
 b. Vortex phenomenon in light winds
 c. Heavy weight of the line conductors
 d. Adoption of horizontal conductor configurations

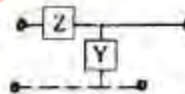
101. In matrix form, the equation of a 4-terminal network representing a transmission line is given by

$$\begin{bmatrix} V_s \\ I_s \end{bmatrix} \begin{bmatrix} A & B \\ C & D \end{bmatrix} \begin{bmatrix} V_R \\ I_R \end{bmatrix}$$

The two networks considered are A.



B.



The plausible transfer matrix for the networks (A) and (B) could be:

i.

$$\begin{bmatrix} 1 & YZ \\ 0 & Z \end{bmatrix}$$

ii.

$$\begin{bmatrix} Y & 0 \\ YZ & 1 \end{bmatrix}$$

iii.

$$\begin{bmatrix} 1 & Z \\ Y & (1 + YZ) \end{bmatrix}$$

iv.

$$\begin{bmatrix} 1 + YZ & Z \\ Y & 1 \end{bmatrix}$$

The correct combination for the two networks (A) and (B), would be:

- a. (i) and (ii)
 b. (i) and (iii)
 c. (ii) and (iv)
 d. (iii) and (iv)

102. The incremental generating costs of two generating units are given by

$$IC_1 = 0.1 X + 20 \text{ Rs./MWhr.}$$

$$IC_2 = 0.15 Y + 20Rs./MWhr.$$

Where X and Y are power (in MW) generated by the two units. For a total demand of 300 MW, the values (in MW) of X and Y will be respectively

- 172 and 128
 - 128 and 172
 - 175 and 125
 - 200 and 100
103. Consider the following statements:
To provide reliable protection for a distribution transformer against over voltages using lightning arrestors, it is essential that the
- Lead resistance is high.
 - Distance between the transformer and the arrestor is small.
 - Transformer and the arrestor have a common interconnecting ground.
 - Spark over voltage of the arrestor is greater than the residual voltage.
- 1, 3 and 4 are correct
 - 2 and 3 are correct
 - 2, 3 and 4 are correct
 - 1 and 4 are correct
104. The reflection coefficient of a short-circuited line is
- 1
 - +1
 - 0.5
 - zero
105. The propagation constant of a transmission line is:
 $0.15 \times 10^{-3} = j1.5 \times 10^{-3}$
The wavelength of the traveling wave is
- $\frac{1.5 \times 10^{-3}}{2\pi}$
 - $\frac{2\pi}{1.5 \times 10^{-3}}$
 - $\frac{1.5 \times 10^{-3}}{\pi}$
 - $\frac{\pi}{1.5 \times 10^{-3}}$
106. Hollow conductors are used in transmission lines to
- Reduce weight of copper
 - Improve stability
 - Reduce corona
 - Increase power transmission capacity

107. In the solution of load-flow equations, Newton Raphson (NR) method is superior to the Gauss-Seidel (GS) method, because the

- Time taken to perform one iteration in the NR method is less when compared to the time taken in the GS method
- Number of iterations required in the NR method is more when compared to that in the GS method
- Number of iterations required is not independent of the size of the system in the NR method
- Convergence characteristics of the NR method are not affected by the selection of slack bus

108. In a synchronous generator, a divided winding rotor is preferable to a conventional winding rotor because of

- Higher efficiency
- Increased steady-state stability limit
- Higher short-circuit ratio
- Better damping

109. A power system network consists of three elements 0 – 1, 1 – 2 and 2 – 0 of per unit impedances 0.2, 0.4 and 0.4 respectively. Its bus impedance matrix is given by

- $\begin{bmatrix} 1 & 2 \\ 7.5 & 2.5 \\ -2.5 & 5.0 \end{bmatrix}$
- $\begin{bmatrix} 1 & 2 \\ 0.16 & 0.5 \\ 0.08 & 0.24 \end{bmatrix}$
- $\begin{bmatrix} 1 & 2 \\ 0.16 & -0.08 \\ -0.08 & 0.24 \end{bmatrix}$
- $\begin{bmatrix} 1 & 2 \\ 0.16 & 0.4 \\ 0.4 & 0.8 \end{bmatrix}$

110. Zero sequence currents can flow from a line into a transformer bank if the windings are in

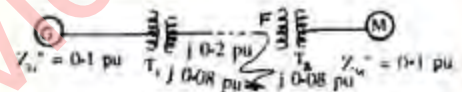
- Grounded star/delta
- Delta/star
- Star/grounded star
- Delta/delta

111. When a line-to-ground fault occurs, the current in a faulted phase is 100 A. The zero sequence current in this case will be

- zero
- 33.3 A
- 66.6 A

- d. 100 A
112. When a 50 MVA, 11kV, 3-phase generator is subjected to a 3-phase fault, the fault current is $-j5$ pu (per unit). When it is subjected to a line-to-line fault, the positive sequence current is $-j4$ pu. The positive and negative sequence reactance's are respectively
- $j 0.2$ and $j 0.05$ pu
 - $j 0.2$ and $j 0.25$ Pu
 - $j 0.25$ and $j 0.25$ Pu
 - $j 0.05$ and $j 0.05$ pu
113. The power generated by two plants are: $P_1=50$ MW, $P_2=40$ MW. If the loss coefficients are $B_{11} = 0.001$, $B_{22} = 0.0025$ and $B_{12} = -0.0005$, then the power loss will be
- 5.5 MW
 - 6.5 MW
 - 4.5 MW
 - 8.5 MW
114. Given that V_m = maximum value of the phase voltage, the average value of the dc voltage for a 3-phase 3-pulse, uncontrolled rectifier is given by
- $V_d = \frac{3\sqrt{3}}{2\pi} V_m$
 - $V_d = \frac{3\sqrt{3}}{\pi} V_m$
 - $V_d = \frac{3}{\pi} V_m$
 - $V_d = \frac{\sqrt{3}}{\pi} V_m$
115. The following data pertain to two alternator working in parallel and supplying a total load of 80 MW:
- Machine 1: 40 MVA with 5% speed regulation
- Machine 2: 60 MVA with 5 % speed regulation.
- The load sharing between machines 1 and 2 will be:
- $\frac{P_1}{48MW} \frac{P_2}{32MW}$
 - $\frac{P_1}{40MW} \frac{P_2}{40MW}$
 - 30 MW
 - 48 MW

116. The combined frequency regulation of machines in area of capacity 1500 MW and operating at a nominal frequency of 60 kHz is 0.1 pu on its own base capacity. The regulation in HZ/MW will be
- 0.1/1500
 - 60/1500
 - 6/1500
 - 60/150
117. The per unit impedance of a synchronous machine is 0.242. If the base voltage is increased by 1.1 times, the per unit value will be
- 0.266
 - 0.242
 - 0.220
 - 0.200
118. The following figure shows the single line diagram of a power system with all reactance's marked in per unit (pu) on the same base



The system is on no-load when a 3-phase fault occurs at 'F' on the high voltage side of the transformer T_2 . The fault current will be

- $-j 0.8187$ pu
 - $+j 0.8187$ pu
 - $-j 8.1871$ pu
 - $+j 8.1871$ pu
119. Rated breaking capacity (MVA) of a circuit breaker is equal to
- The product of rated breaking current (kA) and rated voltage (kV)
 - The product of rated symmetrical breaking current (kA) and rated voltage (kV)
 - The product of breaking current (kA) and fault voltage (kV)
 - Twice the value of rated current (kA) and rated voltage (kV)
120. If, in a short transmission line, resistance and inductance are found to be equal and regulation appears to be zero, then the load will
- Have unity power factor
 - Have zero power factor
 - Be 0.707 leading
 - Be 0.707 lagging