ELECTRICAL ENGINEERING

PAPER-II

1. Which one of the following is employed as a moderator by CANDU type of slow thermal nuclear reactors?
   a. Water
   b. Heavy water
   c. Graphite
   d. Beryllium

2. A power station has maximum demand of 15000 kW. The annual load factor is 50% and plant capacity factor is 40%. What is the reserve capacity of the plant?
   a. 1875 kW
   b. 3750 kW
   c. 6000 kW
   d. 7500 kW

3. A power station's plant load factor is defined as the ratio of
   a. the energy generated to that of maximum energy that could have been generated
   b. average load to peak load
   c. minimum load to peak load
   d. minimum load to average load

4. In a 7/30 A.C. SR conductor why is grease put between steel and aluminium conductors ?
   a. To reduce corrosion by electrolytic action between zinc (galvanising agent on steel) and aluminium
   b. To reduce friction between the strands
   c. To reduce leakage of current from aluminium strands to steel strands
   d. To eliminate air pockets

5. If X is the inductive reactance/phase and R is the resistance/ phase of a short transmission line, what is the power factor angle of the load for maximum voltage regulation?
   a. $\cos^{-1} X/R$
   b. $\tan^{-1} X/R$
   c. $\cos^{-1} R/X$
   d. $\tan^{-1} R/X$

6. For a loss-free long transmission line, the conventional line equations become,
$$V_s = (\cos \beta l)V_R + (j \sin \beta l)I_R$$
   and
$$I_s = \left(\frac{j \sin \beta l}{Z_c}\right)V_R + (\cos \beta l)I_R$$

   Which one of the following statements is correct?
   If the line is terminated at the receiving end by its natural load impedance Z_c, then
   a. the voltage is constant in magnitude at all points along the line and, V_s and V_R always remain in phase.
   b. the voltage is constant in magnitude at all points along the line but V_s advances in phase relative to V_R by an angle β radians per km.
   c. the magnitude of the voltage along the line changes in proportion to the line-length, and the V_s and V_R always remain m phase.
   d. the magnitude of the voltage along the line changes in proportion to the line-length, V_s advances in phase relative to V_R by β radians per km.

7. What is the approximate value of the surge impedance loading of a 400 kV, 3-phase 50 Hz overhead single circuit transmission line?
   a. 230 MW
   b. 400 MW
   c. 1000MW
   d. 1600MW

8. Which one of the following statements is correct?
   The elements of each row of a Y_{BUS} matrix for load flow studies in power system add up to zero.
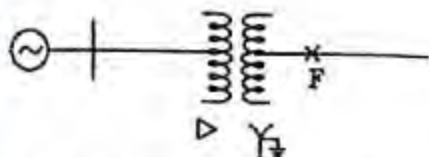   a. always
   b. if the shunt admittances at the buses are ignored.

c. if mutual couplings between transmission lines are absent.

d. if both (b) and (c) are satisfied.

9. For a synchronous generator connected to an infinite bus through a transmission line, how are the change of voltage (ΔV) and the change of frequency (Δf) related to the active power (P) and the relative power (Q)?

a. ΔV is proportional to P and Δf to Q

b. ΔV is proportional to Q and Δf to P

c. Both ΔV and Δf are proportional to P

d. Both ΔV and Δf are proportional to Q

10.

For the system shown in the diagram given above, what is a the transformer the line side of line-to-ground fault on equivalent to ?

a. A line-to-ground fault on the generator side of the transformer

b. A line-to-line fault on the generator side of the transformer

c. A double line-to-ground fault on the generator side of the transformer

d. A 3-phase fault on the generator side of the transformer

11. For which one of the following types of motors, is the equal area criterion for stability applicable?

a. Three-phase synchronous motor

b. Three-phase induction motor

c. D.C. series motor

d. D.C. compound motor

12. The steady state stability limits for round rotor and salient pole 3-phase synchronous generator are attained at the values of power angle δ

a. $= \pi/2$, and $= \pi/2$, respectively

b. $< \pi/2$, and $< \pi/2$, respectively

c. $< \pi/2$, and $= \pi/2$, respectively

d. $= \pi/2$, and $< \pi/2$, respectively

13. A travelling wave due to lightning with an incident voltage V travels through the overhead, line of surge impedance of 400Ω and enters a cable of surge impedance of 40 Ω What is the voltage entering the cable at the junction?

a. V/11

b. 4 V/11

c. 2 V/11

d. V

14. To protect the power transformer (Y — Y with neutral grounded) against fault, what type of connection do the CTs have ?

a. Δ—Y connection

b. Δ—Δ connection

c. Y—Y connection

d. Y—Δ connection

15. The operating point of RI amplifier m an AM receiver is normally biased in

a. Class-A

b. Class-B

c. Class – C

d. Class B-C condition

16. Which one of the following signals can be applied to a delta modulator whose step size is 0.1 V and sampling frequency is 20 π kHz so that no slope overload occurs?

a. $2 \sin (1200\, \pi t)$

b. $1 \sin (2600\, \pi t)$

c. $3 \sin (1000\, \pi t)$

d. $4 \sin (400\, \pi t)$

17. A sinusoidal signal with a random phase is given by $x(t) = A \sin [\pi/2 - (2\pi\, ft + \theta)]$ with the probability density function

$$P_\theta(\theta) = \begin{cases} 1/2\pi, & 0 \le \theta \le 2\pi \\ 0, & \text{otherwise} \end{cases}$$

What is the maximum amplitude of the autocorrelation function of this signal ?

a. A

b. A/2

c. A^2

d. $A^2/2$

18. Consider the following statements :

1. Indirect addressing is not possible for I/O mapped I/O port addresses.

2. Pointers cannot be used to access memory mapped I/O addresses.

3. Fewer machine instructions can be used with I/O mapped I/O addressing as compared to memory mapped I/O addressing.

4. With an 8085 microprocessor, one can access at the most 512 devices with unique addresses using I/O mapped I/O addressing.

Which of the statements given above are correct?

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

19. Which one of the following instructions is a 3-byte instruction?

a. M V I A
b. L D A X B
c. J M P 2050
d. MOV A, M

20. Match List-I (interrupt) with List-II (Property) and select the correct answer using the code given below the Lists :

List-I

A. RST 7.5
B. RST 5.5
C. INTR
D. TRAP

List-II

1. Non -maskable
2. Edge sensitive
3. Level sensitive
4. Non-vectored

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

21. The contents of memory locations 2000 H, 2001 H and 2002 H are AAH, BBH and CCH respectively. What are the contents of H and L registers after executing the following instructions in sequence ?

LXI	H. 2001 H
LHLD	2001 H

Select the correct answer using the codes given below :

a. Contents of H and L registers are 20 H and 01 H, respectively
b. Contents of H and L registers are AAH and BBH, respectively
c. Contents of H and L registers are BBH and CCH, respectively
d. Contents of H and L registers are CCH and BBH, respectively

22. How many times will the following loop be executed?

	L X I B	0010 H
LOOP :	DCX	B
	MOV	A, B
	ORA	C
	JNZ	LOOP

Select the correct answer using the code given below :

a. 10
b. 100
c. 16
d. 15

23. In 8085, the DAA instruction is used for

a. Direct Address Accumulator
b. Double Add Accumulator
c. Decimal Adjust Accumulator
d. Direct Mess Accumulator

24. Processor status word of 8085 microprocessor has five flags. Which are these five flags?

a. S, Z, AC, P, CY
b. S, OV, AC, P, CY
c. S, X, OV, P, CY
d. S, Z, AC, P, OV

25. Suppose 64 kB, ROM ICs, are available in abundance. 1 MB ROM can be obtained from

a. 16 ICs in a row
b. 16 ICs in a column
c. 8 ICs in a column and 2 ICs in a row
d. None of the above

26. Which one of the following is the software intercept of 8085 microprocessor?

a. RST 7.5
b. RST 7
c. TRAP
d. INT1R

27. Match List-I (Device) with List-II (Application) and select the correct answer using the code given below the Lists :

List- I

A. Diode
B. Transistor
C. Tunnel Diode
D. Zener Diode

List-II

1. Amplifier
2. Oscillator
3. Rectifier
4. Voltage Regulator

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

28. Match List-I (Type of Amplifier/ Configuration) with List-II (Characteristic Property) and select the correct answer using code given below the Lists :

List- I

A. Common emitter amplifier
B. Emitter follower
C. Common base amplifier
D. Darlington pair

List-II

1. Very low output resistance
2. Current gain ≈ 1
3. Beta multiplication
4. Very high power gain

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

29. Match List-I (Type of Diode) with List-II (Characteristics/ Applications) and select the correct answer using the code given below the Lists :

List-I

A. Tunnel diode
B. Zener diode
C. Photodiode
D. Schottky diode

List-II

1. Reverse current varies directly with the amount of light
2. Exhibits negative resistance region in its I-C characteristic
3. Uses only majority carriers and is intended for high frequency operations
4. Silicon p-n junction diode that is designed for limiting the voltage across the terminals in reverse bias

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

30. Match List-I (Parameter) with List-II (Variation) and select the correct answer using the code given below the Lists :
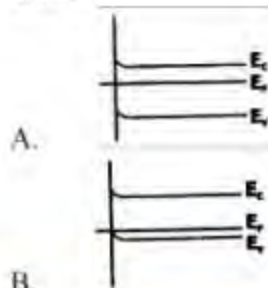
List- I

A. Electron mobility around room temperature
B. Energy gap
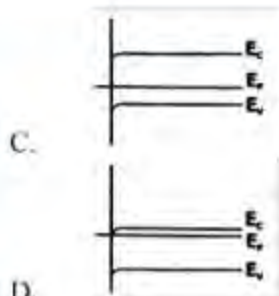C. Intrinsic carrier concentration
D. Mole density (gm/mole)

List-II

1. Increases with temperature
2. Decreases with temperature
3. Remains constant as temperature is varied

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

31. Match List-I (Metal semiconductor Band Diagram under Equilibrium) with List-II (Type of Contact) and select the correct answer using the code given below the Lists :

List-I

A.

B.

C.

D.

List - II

1. Rectifier to n-type
2. Ohmic to n-type
3. Rectifier to p-type
4. Ohmic to p-type

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

32. Consider the following statements

Data that are stored at a given address in a random access memory are lost

1. when power goes off.
2. when the data are read from the address.
3. when new data are written at the address.
4. because it is non-volatile memory.

Which of the statements given above are correct?

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

33.

The circuit shown above is the Thevenin's equivalent circuit of a centre-tapped full wave rectifier with diode forward resistance $R_f = 100 \, \Omega$, transformer secondary coil resistance $R_s = 30\Omega$, peak input voltage $V_m = 10$ V.

What are the values of V and R_{th} respectively?

a. 10 V, 100 Ω

b. 6.36 V, 130 Ω
c. 6.36 V, 115 Ω
d. 4.54 V, 130 Ω

34. What is the value of the load angle when the power output of a salient pole synchronous generator is maximum?

a. 0^0
b. 45^0
c. 90°
d. None of the above

35. Which one of the following statements is not correct in respect of synchronous machines?

a. In salient pole machines, the direct-axis synchronous reactance is greater than the quadrature axis synchronous reactance.
b. The damper bars help the motor to self-start.
c. Short circuit ratio is the ratio of the field current required to produce the rated voltage on open circuit to the rated armature current.
d. The V-curve of a synchronous motor represents the variation in the armature current with field excitation at a given output power.
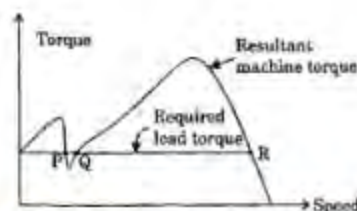
36. In which one of the following is reluctance power developed?

a. Salient pole alternator
b. Non-salient pole alternator
c. Squirrel cage induction motor
d. Transformer

37. When the applied rated voltage per phase is reduced to one-half, the starting torque of a three-phase squirrel cage induction motor becomes

a. 1/2 of the initial value
b. 1/4 of the initial value
c. Twice of the initial value
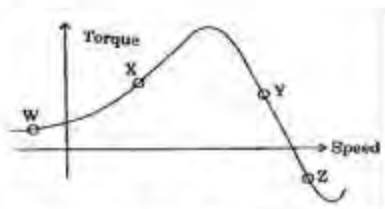d. 4 times of the initial value

38.

The required load torque line intersects the resultant torque- speed characteristic of a 3-phase squirrel cage induction motor at points P, Q and R as shown in the figure above. Which is/are the stable opening point(s) ?

a. P and Q
b. Q and R
c. P and R
d. Only R

39.

Which of the points on the torque-speed curve of induction motor represent operation at a slip greater than the 1?

a. W
b. X
c. Y
d. Z

40. If the load on an induction motor is increased from no load to full load, its slip and the power factor will, respectively

a. decrease, decrease
b. decrease, increase
c. increase, decrease
d. increase, increase

41. The voltage actually used for setting up of the useful flux in the air gap of a 3-phase induction motor is

a. = Applied voltage
b. > Applied voltage
c. < Applied voltage
d. = Rotor induced emf

42. Which one of the following is the type of single phase induction motor having the highest power factor at full load?

a. Shaded pole type
b. Split-phase type
c. Capacitor-start type
d. Capacitor-run type

43. A single phase induction motor is running at N r.p.m. Its synchronous speed is N_s. If its slip with respect to forward field is s,

What is the slip with respect to the backward field?

a. s
b. —s
c. (1 — s)
d. (2 — s)

44. Which one of the following has the highest numerical value in a stepper motor?

a. Detent torque
b. Holding torque
c. Dynamic torque
d. Ripple torque

45. Match List-I (Power Station) with List-II (Component) and select the correct answer using the code given below

List- I
A. Hydroelectric power station
B. Nuclear power station
C. Steam power station
D. Pressure gasification combined cycle power plant

List-II
1. Grate and stokers
2. Forebay
3. Pressurized water reactor
4. Fluidized bed gasifier

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

46. In hydro power stations, what is an enlarged body of water just above the intake and used as a regulating reservoir, called ?

a. Spillways
b. Forebay
c. Reservoir
d. Penstock

47. For variable heads of near about but less than 30 metres, which type of turbines is used in hydro power stations ?

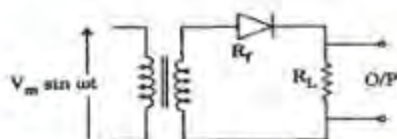a. Pelton
b. Kaplan
c. Francis
d. None of the above

48. Which one of the following parameters in an induction motor influences the magnetizing reactance to the maximum extent?
   a. Axial length of the rotor stack
   b. Axial length of the stator stack
   c. Radial length of air gap
   d. Number of slots on the stator

49. Which one of the following equations represents the energy gap (E_G) variation of silicon with temperature (T)?
   a. $E_G(T) = 2.11 - 3.60 \times 10^{-4} T$
   b. $E_G(T) = 1.21 - 3.60 \times 10^{-4} T$
   c. $E_G(T) = 1.41 - 2.23 \times 10^{-4} T$
   d. $E_G(T) = 0.785 - 2.23 \times 10^{-4} T$

50.

   Consider the circuit given above where R_f is the diode forward resistance and R_L the load resistance. What is the average rectified current equal to ?
   a. $V_m / (R_L + R_f)$
   b. $V_m / \{\pi(R_f + R_L)\}$
   c. $2V_m / \pi$
   d. $V_m / \{\sqrt{2}(R_L + R_f))$

51. In a Hall effect experiment, a p-type semiconductor sample with hole concentration p_1 is used. The measured value of the Hall voltage is now replaced by another p-type sample with hole concentration p_2 where $p_2 = 2 p_1$, what is the new Hall voltage VH_2?
   a. $2V_{H1}$
   b. $4 V_{H1}$
   c. $(1/2) V_{H1}$
   d. $(1/4) V_{H1}$

52. What is the thermal runaway in a bipolar junction transistor biased in the active region due to ?
   a. Heating of the transistor emitter region
   b. Changes in 'β' which increases with temperature
   c. Base emitter voltage V_{BE} which decreases with rise in temperature
   d. Increase in reverse collector - base saturation current due to rise in internal device temperature
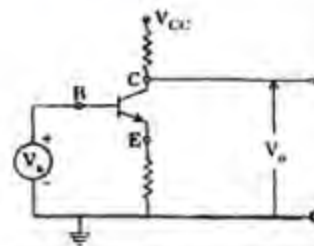
53. The reverse saturation current of a Si-based p-n junction diode increases 32 times due to a rise in ambient temperature. If the original temperature was 400 C, what is the final temperature?
   a. 90°C
   b. 72°C
   c. 450 C
   d. 500 C

54. What is the main difference between MOSFETs and BJTs in terms of their I — V characteristics?
   a. Current in quadratic with V_{GS} for MOSFETs and linear with V_{BE} for BJTs
   b. Current in linear with V_{GS} for MOSFETs and exponential with V_{BE} for BJTs
   c. Current is exponential with V_{GS}/V_{BE} in both these devices, but rise is faster in MOSFETs
   d. Current in quadratic with V for MOSFETs and exponential with VBE for BJTs

55.

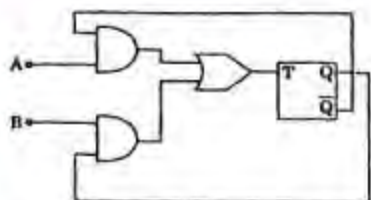   In the circuit given above, if the output is taken from point E instead of node C, what will be the result?
   a. An increase in the output impedance
   b. A reduction in the output impedance
   c. An increase in the input impedance
   d. A reduction in the input impedance

56. If an input periodic signal with non-zero d.c. component is impressed upon a high-pass RC circuit, what will be the d.c. component in the output waveform?
   a. Zero
   b. It depends on the value of the capacitor
   c. It depends on the value of the resistor

d. Same as that in input

57.

What is represented by the digital circuit given above ?
a. An SR flip-flop with A = S and B = R
b. A JK flip-flop with A = K and B = J
c. A JK flip-flop with A = J and B = K
d. An SR flip-flop with A = R and B = S

58. Which one of the following is not a characteristic of CMOS configuration ?
a. CMOS devices dissipate much lower static power than bipolar devices
b. CMOS devices have low input impedances
c. CMOS devices have higher noise margins
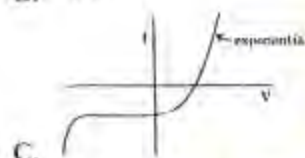d. CMOS devices have much lower transconductance than bipolar devices

59. For an n-type semiconductor having any doping level, which of the following hold(s) good :
1. $p_n N_D = n_i^2$
2. $p_p N_D = n_i^2$
3. $n_n N_D = n_i^2$
4. $p_n n_n = n_i^2$

Select the correct answer using the code given below :
a. 1 and 4
b. 2 and 4
c. 3 and 4
d. Only 4

60. Match the I-V characteristics given below with Gunn diode, Photo diode and Tunnel diode.

A.

B.

C.

Select the correct answer using the code given below :

	Gunn diode	Photo diode	Tunnel diode
a.	A	B	C
b.	B	A	C
c.	A	C	B
d.	B	C	A

61. Consider the following statements :
In frequency response of n-stage amplifiers,
1. lower cut-off frequency is $(2^{1/n}-1)$ times that of a single stage.
2. upper cut-off frequency is $(2^{1/n}-1)$ times that of a single stage.
3. lower cut-off frequency is $(2^{1/n}-1)^{-1}$ times that of a single stage.
4. upper cut-off frequency is $(2^{1/n}-1)^{-1}$ times that of a single stage.

Which of the statements given above are correct ?
a. 1 and 2
b. 1 and 3
c. 2 and 4
d. 3 and 4

62. Consider the following statements :
An applied bias voltage in a p-n junction diode (n region positive with respect to p region) results in
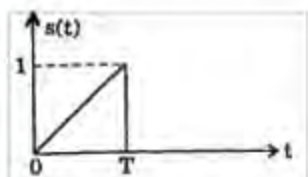1. increase in potential barrier.
2. reduction in space charge layer width.
3. increase in space charge layer width.
4. increase in magnitude of electric field.

Which of the statements given above are correct ?
a. 1 and 2
b. 1 and 3
c. 1 and 4
d. 1, 3 and 4

63. Which one of the following statements is correct in respect of a BJT?
    a. Avalanche multiplication starts when the reverse biased collector-base voltage V_{CB} equals the avalanche breakdown voltage BV_{CBO}.
    b. The early effect starts as soon as punch through occurs in a transistor.
    c. The small signal current gain h_{fe} = large signal current gain h_{FE} when $\partial h_{FE}/\partial I_C = 0$.
    d. In the CE mode, a transistor can be cut off by reducing I_B to zero.

64.

Which one of the following is the impulse response of a matched filter for a singla $s(t)$ of the type shown above?
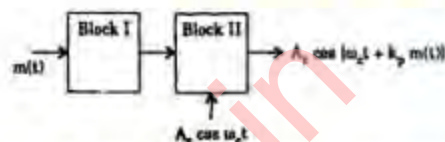

a.

b.

c.

d.

65. Which one of the following is the available noise power produced by a noisy resistor K? [k = Boltzmann Constant, T Temperature and B Bandwidth]
    a. kTB
    b. 4 kTh
    c. 4 kTBR
    d. 2 kTBR

66. A DSB-SC signal i generated using the carrier signal $\cos(w_c t + \theta)$ and modulating signal m(t). What is the envelop detector output of this DSB-SC signal?
    a. $m(t)\cos\theta$
    b. $|m(t)|$
    c. $m(t)\tan\theta$
    d. $m(t)\sin\theta$

67.

Which one of the following sets correctly describes the Block I and Block II in the diagram given above?

	Block I	Block II
A.	Integrator	Phase modulator
B.	Integrator	Frequency modulator
C.	Differentiator	Phase modulator
D.	Differentiator	Frequency modulator

68. The original spectrum of a message contains 100 Hz, 200 Hz frequency components, it is amplitude modulated by a carrier of 0.9 kHz. Which frequency components are contained in the amplitude modulated signal spectrum?
    a. 900, 1000 and 1100 Hz
    b. 700, 800 and 900 Hz
    c. 700, 800, 900, 1000 and 1100 Hz
    d. 100, 200 and 900 Hz

69. If two signals modulate the same carrier with different modulation depths of 0.3 and 0.9, the resulting modulation signal will
    a. be over-modulated
    b. have the resultant modulation limited to 1.0
    c. have the resultant modulation index around 0.82
    d. have the resultant modulation index around 0.95

70. Match List-I (Modulation) with List-II (Application) and select the correct answer using the code given below:

List- I

A. Wind band FM

B. Narrow band FM

C. AM

D. VSB-AM

List-II

1. Mobile communicator
2. Superimposition of binary waveform on carrier
3. TV video
4. TV audio
5. Medium wave broadcast

	A	B	C	D
a.	4	3	5	1
b.	5	1	2	3
c.	4	1	5	3
d.	5	3	2	1

71. Match List-I (Parameter) With List-II (Value of Parameter) and select the correct answer using the code given below:

List-I

A. Line blanking period

B. Line synchronization pulse

C. Vertical field pulse

D. Duration of pre-equalizing pulse sequence

List - II

1. 4.5 to 4.9 μs
2. 155 to 165 μs
3. 11.8 to 12.3 μs
4. 20,000 μs

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

72. Which of the following are the advantages of FM broadcasting over AM broadcasting?

1. Better S/N ratio
2. Not subject to signal fading
3. Power efficiency is superior
4. Demodulation is simpler

Select the correct answer using the code given below:

a. 1 and 2

b. 1, 2 and 4

c. 2, 3 and 4

d. 1 and 3

73. Consider the following statements about analog data-digital signal :

1. Amplifiers used in repeaters produce additive noise.
2. FDM is used for digital signals whereas TDM is used for analog signals.
3. With TDM there is no intermodulation noise whereas this is a concern for FDM.
4. Conversion to digital signalling allows the use of efficient digital switching techniques.

Which of the statements given above are correct?

a. 1 and 2

b. 3 and 4

c. 1, 2 and 3

d. 1, 2, 3 and 4

74. A resistor connected across the gate and cathode of an SCR

a. increases dv/dt rating of SCR

b. increases holding current of SCR

c. decreases noise immunity of SCR

d. increases turn-off time of SCR

75. Turn-on of a thyristor takes place when

a. anode to cathode voltage is positive

b. anode to cathode voltage is negative

c. there is a positive current pulse at the gate

d. the anode to cathode voltage is positive and there is a positive current pulse at the gate

76. Which is the most suitable power device for high frequency (>100 kHz) switching application?

a. Power MOSFET

b. Bipolar junction transfer

c. Schottky diode

d. Microwave transistor

77. Match List-I with List-II and select the correct answer using the code given below the Lists :

List-I

A. Voltage source inverter

B. Current source inverter

C. Phase controlled a.c. to d.c. converter

D. Cycloconverter

List-II

1. Large source inductance
2. Poor power factor
3. Inverter limit
4. Small source inductance

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

78. In a dual converter, the circulating current
   a. allows smooth reversal of load current, but increases the response time
   b. allows smooth reversal of load current with improved speed of response
   c. does not allow smooth reversal of load current, but reduces the response time
   d. flows if there is no interconnecting inductor

79. Match List-I (Type of Fault) with List-II (Type of Protection) and select the correct answer using the code given below:

List- I

A. External phase fault
B. Faults between phases
C. Phase to earth fault
D. Overheating

List-II

1. Differential protection
2. Earth fault relay
3. Over-current protection (inverse time delay o/c relay)
4. Thermal relay

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

80. How many relays are used to detect inter phase fault of a three-line system ?
   a. One
   b. Two
   c. Three
   d. Six

81. Which is the main relay for protecting up to 90% of the transmission line-length in the forward direction?
   a. Directional over-current relay
   b. Mho relay
   c. Carrier-current protective relay
   d. Impedance relay

82. High voltage d.c. transmission requires filters for
   a. current harmonics on a.c. side voltage harmonics on d.c. side
   b. voltage harmonics on a.c. side and current harmonics on d.c. side
   c. voltage harmonics on both a.c. and d.c. sides
   d. current harmonics on both a.c. and d.c. sides

83. If p is the pulse number and n is an integer, what is the order of harmonics on a.c. side and d.c. side of an HVDC converter?
   a. $(np + 1)$ and $(np - 1)$, respectively
   b. $(np - 1)$ and, np respectively
   c. $(np + 1)$ and np, respectively
   d. $(np \pm 1)$ and np, respectively

84. In a biased step-graded p-n junction, what is the correct expression for the equilibrium contact potential (V_0)?
   a. $V_0 = V_T \ln (N_A/N_D \, n_i^2)$
   b. $V_0 = V_T \ln (N_D/N_A \, n_i^2)$
   c. $V_0 = V_T \ln (N_A N_D / n_i^2)$
   d. $V_0 = V_T \ln (n_i^2 / N_A N_D)$

   where $V_T \propto T/q$, T being the temperature, q the electronic charge, N_A and N_D are the doping levels of the p and n region respectively, and n_i is the intrinsic carrier concentration.

85. In an unbiased p-n junction, the junction current at equilibrium is
   a. due to diffusion of majority carriers only
   b. due to diffusion of minority carriers only
   c. zero, because equal and opposite drift and diffusion currents for electrons and holes cross the junction
   d. zero, because no charges cross the junction

86. What is the purpose of impedance matching between the output of previous stage and input of next stage in a cascaded amplifiers
    a. To achieve high efficiency
    b. To achieve maximum power transfer
    c. To achieve reduced distortion
    d. To achieve reduced noise

87. In a bridge, a.c. to d.c. converter using p-n diodes, if the input voltage is V sin ωt, what is the peak inverse voltage across any diode?
    a. V
    b. 2V
    c. V/2
    d. $V/\sqrt{2}$

88. Why is an external pass resistor used in a voltage regulator?
    a. For short circuit protection
    b. For increasing the current that regulator can handle
    c. For increasing the output voltage
    d. For improving the regulation

89. What is the power factor of a single phase a.c. regulator feeding a resistive load?
    a. (Per unit power)^2
    b. (Per unit power)$^{1/2}$
    c. $\dfrac{(\text{Per unit Power})^{3}}{\sqrt{2}}$
    d. $\dfrac{(\text{Per unit Power})^{1/2}}{2}$

90. When the firing angle α of a single phase fully controlled rectifier feeding constant d.c. current into the load is 30^0, what is the displacement factor of the rectifier?
    a. 1
    b. 0.5
    c. $\sqrt{3}$
    d. $\sqrt{3}/2$

91. For the same voltage output, which one of the following has larger peak inverse voltage of the thyristor?
    a. Single phase full wave centre tapped circuit
    b. Single phase full wave bridge circuit
    c. Three phase full wave cridge circuit
    d. Three phase full wave centre tapped circuit

92. In a three phase voltage source inverter operating in square wave mode, the output line voltage is free from
    a. 3rd harmonic
    b. 7th harmonic
    c. 11th harmonic
    d. 13th harmonic

93. A fully controlled line communtated converter functions as an invertor when firing angle (a) is in the range
    a. $0^0 - 90^0$
    b. $90^0 - 180^0$
    c. $90^0 - 180^0$ only when there is a suitable d.c. source in the load
    d. $90^0 - 180^0$ only when it supplies a back e.m.f. load

94. Which of the following devices should be used as a switch in a low power switched mode power supply (SMPS)?
    a. GTO
    b. MOSFET
    c. TRIAC
    d. THYRISTOR

95. Assertion (A) : Under V/f control of induction motor, the maximum value of the developed torque remains constant over a wide range of speed in the sub-synchronous region.
    Reason (R) : The magnetic flux is maintained almost constant at the rated value by keeping the ration V/f constant over the considered speed range.
    a. Both A and R are individually true and R is the correct explanation of A
    b. Both A and R are individually true but R is not the correct explanation of A
    c. A is true but R is false
    d. A is false but R is true

96. Assertion (A) : Bus admittance matrix is a sparse matrix.
    Reason (R) : In load flow studies, one of the buses is taken as a slack bus.
    a. Both A and R are individually true and R is the correct explanation of A
    b. Both A and R are individually true but R is not the correct explanation of A
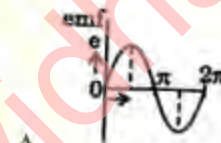   c. A is true but R is false

d. A is false but R is true

97. Assertion (A) : Present day, surge diverters use nonlinear resistance elements.

Reason (R) : A non-linear resistance element has the property that its resistance increases sharply as the voltage across it increases.

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

98. Assertion (A) : In JFET, the phenomenon of thermal runaway is not observed around room temperature.

Reason (R) : The heat dissipation in the semiconductor increases its temperature which increases the carrier mobility with temperature.

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

99. Assertion (A) : In a good power supply, the percentage of voltage regulation should be close to zero.

Reason (R) : Zero percentage regulation means that there will be no change in output voltage if the load resistance varies between the limits 0 to ∞.

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

100. Assertion (A) : A clamping network produces an output signal which is a replica of the input signal.

Reason (R) : A clamping circuit removes a part of the input signal.

a. Both A and R are individually true and R is the correct explanation of A
b. Both A and R are individually true but R is not the correct explanation of A
c. A is true but R is false

d. A is false but R is true

101. Assertion (A) : Stack is a group of memory locations in RAM used for temporary storage of data.

Reason (R) : PUSH and POP instructions are used to send and retrieve data from stack.

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

102. Assertion (A) : In frequency division multiplexing (FDM), different carriers are to be generated for different channels. Also, each channel occupies a separate frequency band and different band pass filters are employed.

Reason (R) : The non-linearities in various amplifiers of an FDM system do not produce any harmonic distortion and there is no interference within, the channels.

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

103. A loss-less cylindrical rotor synchronous generator is floating on the system bus-bar after being, properly synchronised and is running at no-load. Now, if the prime mover is acting as a mechanical load on the machine, then

a. the torque developed by the machine will act in the same direction as the prime-mover torque
b. the torque developed by the machine will act in the opposite direction to that of the prime-mover torque
c. the machine rotor would fall-back and induced emf would lag behind the terminal voltage
d. the machine rotor would overspeed and the induced emf would lead the terminal voltage

104. The resultant flux density in the air gap of a synchronous generator is the lowest during

a. Open circuit

b. Solid short circuit

c. Full load

d. Hald load

105. A 50 kW d.c. shunt motor is loaded to draw rated armature current at any given speed. When driven (i) at half the rated speed by armature voltage control and (ii) at 1.5 times the rated speed by field control, what are the approximate output powers delivered by the motor?

a. 25 kW in (1) and 75 kW in (ii)

b. 25 kW in (i) and 50 kW in (ii)

c. 50 kW in (i) and 75 kW in (ii)

d. 50 kW in (i) and 50 kW in (ii)

106. For a constant supply voltage, what are the effects of inserting a series resistance in the field circuit of a d.c. shunt motor, on its speed and torque ?

a. Speed will decrease and the torque will decrease

b. Speed will increase and the torque will. increase

c. Speed will increase and the torque will decrease

d. Speed will decrease and the torque will increase

107. Consider the following statements in respect of d.c. generators:

1. Compensating windings are located in teeth cut out in main poles.

2. Compensating windings are series connected so that the armature reaction is aided at any load.

3. Compensating windings are series connected for cancellation of the armature reaction at any load.

4. Compensating windings are shunt connected to aid, the poles at any load.

Which of the statements given above are correct?

a. 1 and 2

b. 1, 2 and 3

c. 1 and 3

d. 2, 3 and 4

108. A self-excited d.c. shunt generator, driven by its prime-mover at the rated speed 1ils to build up voltage across its terminals at no-load. What reason can be assigned for this?
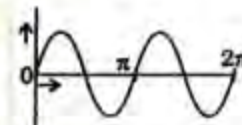
a. The field circuit resistance is higher than the critical resistance

b. The initial shunt field emf does not assist the residual resistance

c. One of the inter-pole connections is reversed

d. The brush-axis shifts slightly from the geometrical neutral axis of the machine

109. Wave winding is employed in a d.c. machine of

a. high current and low voltage rating

b. low current and high voltage rating

c. high current and high voltage rating
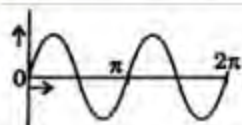
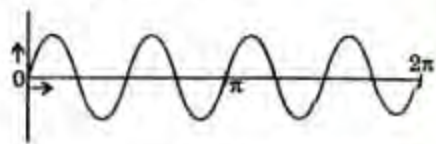d. low current and low voltage rating

110.

An elementary cylindrical machine has one full-pitch coil in the stator, but the rotor may have (i) two poles or (ii) four poles of permanent magnets.
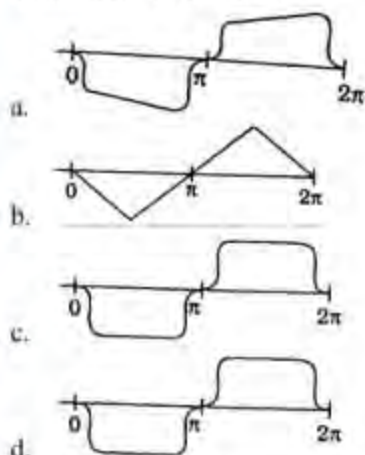
The time-varying voltage that could be induced in the stator coil for one rotation of the rotor, while the rotor is revolving at a constant speed are shown iii the figures A, B, C and D above.

Select the correct combination from the code given below:

	2-pole	4-pole
a.	A	D
b.	A	B
c.	C	D

111. What is the form of an air gap flux density waveform of an uncompensated 2-pole d.c. shunt motor at full-load?

a.

b.

c.

d.

112. Which three-phase connection can be used in a transformer to introduce a phase difference of 30^0 between its output and corresponding input line voltages?
   a. Star-delta
   b. Star-star
   c. Delta-delta
   d. Delta-zigzag

113. What is the efficiency of an auto-transformer in comparison to that of a two-winding transformer of the same rating?
   a. Slightly less than that of a two-winding transformer
   b. Same as that of a two-winding transformer
   c. More than that of a two-winding transformer
   d. As low as $1/5^{th}$ of the efficiency of a two-winding transformer

114. A two-winding transformer is converted into an auto-transformer. If we apply additive polarity and subtractive polarity for the connections, then the secondary voltage is 2640 V and 2160 V, respectively. What is the ratio of primary to secondary voltage on the original transformer?
   a. 66 : 54
   b. 54 : 66
   c. 10 : 1
   d. 1 : 10

115. Percentage resistance and percentage reactance of a transformer are 1% and 4%, respectively. What is voltage regulation at power factor 0.8 lagging and 0.8 leading?
   a. 2.4% and –0.8%, respectively
   b. 3.2% and —1.6%, respectively
   c. 3.2 % and —3.2%, respectively
   d. 4.8% and 1.6%, respectively

116. If P_1 and P_2 be the iron and copper losses of a transformer at full load, and the maximum efficiency of the transformer is at 75% of the full load, then what is the ratio of P_1 and P_2 ?
   a. 9/16
   b. 10/16
   c. 3/4
   d. 3/16

117. If the iron core of a transformer is replaced by an air core, then the hysteresis losses in the transformer will
   a. increase
   b. decrease
   c. remain unchanged
   d. become zero

118. The equivalent circuit of a transformer has the leakage reactances X_1, X_2' and the magnetising reactance X_m. What is the relationship between their magnitudes?
   a. $X_1 \gg X_2' \gg X_m$
   b. $X_1 \ll X_2' \ll X_m$
   c. $X_1 \approx X_2 \gg X_m$
   d. $X_1 \approx X_2' \ll X_m$

119. If the voltage applied to a transformer primary is increased by keeping the V/f ration fixed, then the magnetizing current and the core loss will, respectively,
   a. decrease and remain the same
   b. increase and decrease
   c. remain the same and remain the same
   d. remain the same and increase

120. Which among the following magnetic materials has the highest energy-product to make it a permanent magnet?
   a. Alnico
   b. Ferrite
   c. Samarium Cobalt
   d. Cobalt-Iron alloy