OBJECTIVE PAPER-II

1. Compared to the salient-pole Hydro-electric generators, the steam and the gas-turbine generators have cylindrical rotors for
(A) Better air-circulation in the machine
(B) Reducing the eddy-current losses in the rotor.
(C) Accommodating larger number of terms in the field winding
(D) Providing higher mechanical strength against the centrifugal stress

Key: (D)

Sol: Cylindrical Rotors are used for High speed application because of good mechanical strength whereas salient pole rotors are used for low speed applications because of less mechanical strength.

2. Consider the following losses for short circuit test on a transformer:
1. Copper loss
2. Copper and iron losses
3. Eddy current and hysteresis losses
4. Friction and windage losses

Which of the above is/are correct?
(A) 1 only (B) 2 only
(C) 3 only (D) 2, 3 and 4

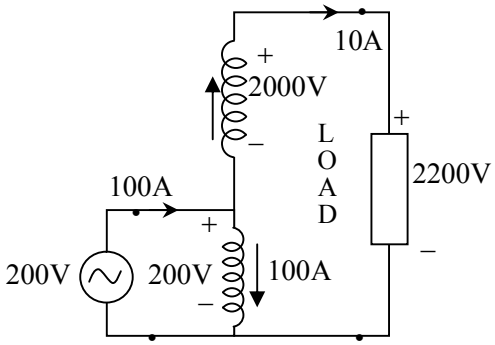
Key: (A)

Sol: S.C. test on Transformer will be conducted at less than the rated voltage, but at rated current. Therefore the Losses associated with current will be rated losses and with voltage will be very small.
i.e., copper losses can be considered whereas Iron losses can be neglected.
Note: Friction & Windage losses are absent since there is no rotating part.

3. A 2000 V/200 V, 20 kVA, two winding, single phase transformer is reconnected as a step up auto-transformer having 200 V/2200 V ratings. Then the power rating for the auto transformer will be:
(A) 160 kVA (B) 180 kVA
(C) 200 kVA (D) 220 kVA

Key: (D)

Sol: Auto T/F configuration



$$I_{FL}\text{ on HV} = \frac{20\times10^3}{2000} = 10\text{A}$$

$$I_{FL}\text{ on LV} = \frac{20\times10^3}{200} = 100\text{A}$$

$$\text{Rating of Auto Transformer} = 2200\times10$$
$$= 22\,\text{kVA}$$
$$(\text{or})$$
$$= 200\times110$$
$$= 22\,\text{kVA}$$

4. The regulation of a transformer in which ohmic loss is 1% of the output and reactance drop is 5% of the voltage, when operating at 0.8 power factor lagging, is
(A) 3.8% (B) 4.8%
(C) 5.2% (D) 5.8%

Key: (A)

Sol: $\%\text{Regulation} = \%R\cos\phi_2 \pm \%X\sin\phi_2$.

$$\begin{bmatrix}(+)\Rightarrow\text{lagg}\\(-)\Rightarrow\text{lead}\end{bmatrix}$$

$$= \frac{1}{100}\times0.8 + \frac{5}{100}\times0.6$$

$= 3.8\%$

Note: Ohmic loss = % R=Resistance drop.

5. In a power transformer, the core loss is 50 W at 40 Hz, and 100 W at 60 Hz, under the condition of same maximum flux density in both cases. The core loss at 50 Hz will be

(A) 64 W (B) 73 W

(C) 82 W (D) 91 W

Key: (B)

Sol: Separation of Iron losses into Hysteresis & Eddy current losses

$W_i = 50W$ at $40Hz$.

$\frac{W_i}{f} = A + Bf$ $W_i = 100W$ at $60Hz$

$W_i = ?$ at $50Hz$

We Know, $\left.\begin{matrix} W_h \propto f \\ W_e \propto f^2 \end{matrix}\right\}$ If "f" increases W_i increases and vice versa

$\therefore$ at 50Hz the W_i will be in between >50W and <100W.

$$\frac{50}{40} = A + B40 \quad ..(1)$$

$$\frac{\frac{100}{60} = A + B60}{\left(\frac{5}{3} - \frac{5}{4}\right) = B20} \quad ..(2)$$

$$\Rightarrow B = \frac{1}{48}$$

Substituted 'B' Value in any one equation

we get A as $\frac{5}{12}$

$\therefore W_i$ at 50Hz will be

$$\frac{W_i}{50} = \frac{5}{12} + \frac{1}{48} \times 50$$

$W_i = 72.9166$ watts

$\simeq 73$ watts

6. Consider the following advantages of a distributed winding in a rotating machine:

1. Better utilization of core as a number of evenly placed small slots are used.
2. Improved waveform as harmonic emf's are reduced
3. Diminished armature reaction and efficient cooling.

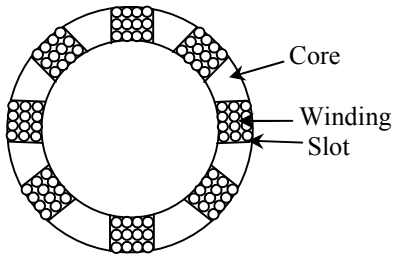
Which of the above advantages are correct?

(A) 1 and 2 only (B) 1 and 3 only

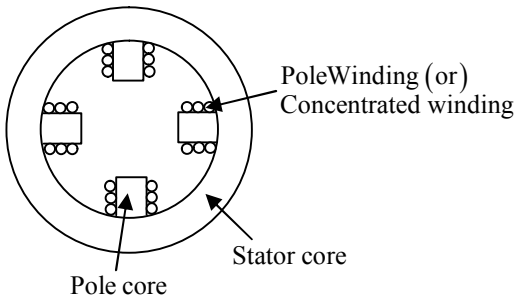
(C) 2 and 3 only (D) 1, 2 and 3

Key: (D)

Sol: A pictorial view of Concentrated & Distributed winding machines



Figure(a): Distributed winding



Figure(b): Concentrated Winding

Figure (a): As the winding is distributed, the given 3 statements are possible.

Figure (b): As the winding is concentrated, the given 3 statements are not possible (impossible).

7. The breadth factor for 3rd harmonic emf of a 3-phase, 4-pole, synchronous machine having 36 stator slots is

(A) 0.47 (B) 0.53 (C) 0.67 (D) 0.73

Key: (C)

Sol: Slots=36, P=4, 3 phase, n=3.

$$K_d = \frac{\sin mn\theta/2}{m\sin n\theta/2} \qquad m = \frac{\text{no.of slots per pole}}{\text{Phase}}$$

$$= \frac{\sin 3\times 3\times 20/2}{3\sin 3\times 20/2} \qquad \frac{36}{\frac{4}{3}} = 3$$

$$K_d = 0.666 \simeq 0.67 \qquad \theta = \frac{180}{\frac{36}{4}} = 20^o$$

8. Consider the following factors for a dc machine:

1. Interpole
2. Armature resistance
3. Reduction in field current

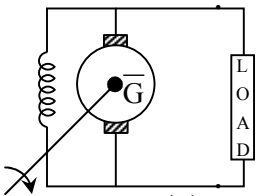
Which of the above factors are responsible for decrease in terminal voltage of a shunt generator?

(A) 1 and 2 only (B) 2 and 3 only

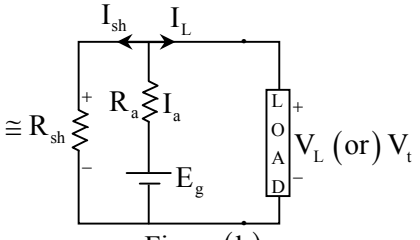
(C) 1 and 3 only (D) 1, 2 and 3

Key: (B)

Sol: Electrical Equivalent circuit of D.C. shunt Generator.



Figure(a)



Figure(b)

From the figure (b), we can say that, the fall in terminal voltage is because of

1. Armature Resistance R_a
2. Field Current.

→ If 'R_a' increases, then $V_t = (E_g - I_aR_a)$ falls.

→ If field current (I_f) Reduces, then flux reduces and "E_g' reduces finally results in reduction in V_t. $\left(V_t \propto E_g \propto \phi \propto I_f\right)$.

Note: Inter poles are used to improve the commutation and also to reduce the armature reaction.

9. A dc motor develops an electromagnetic torque of 150 N-m in a certain operating condition. Form this operating condition, a 10% reduction in field flux and 50% increase in armature current is made. What will be new value of electromagnetic torque?

(A) 225 N – m (B) 202.5 N – m

(C) 22.5 N – m (D) 20.25 N – m

Key: (B)

Sol: We know that $T_{em} \propto \phi I_a$

$$T_{em_2} = T_{em_1}$$

$$\phi_2 I_{a2} = \phi_1 I_{a1}$$

$$(0.9\phi_1)(1.5I_{a1}) = \phi_1 I_{a1}$$

$$1.35\phi_1 I_{a1} = \phi_1 I_{a1}$$

$$(35\% \Uparrow)$$

As flux reduced by 10% and I_a increased by 50%, we can say that T_{em} will increase.

i.e., T_{em}, increased by 35%

$$\text{i.e., } 150\times\frac{35}{100} = 52.5 \text{ N} - \text{m}$$

$$\therefore \text{The new } T_{em} = 150 + 52.5$$

$$= 202.5 \text{ N} - \text{m}$$

10. A dc machine, having a symmetrical closed-circuit armature winding and a sinusoidal air-gap flux-density distribution, will have a

sinusoidal voltage induced in the individual coils. The resultant brush-to-brush voltage will have a waveform

(A) Sinusoidal with the negative-half reverse

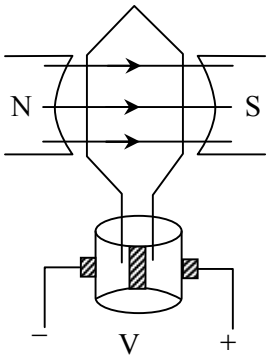
(B) Unidirectional and constant without any ripples

(C) Unidirectional and constant with ripples superimposed

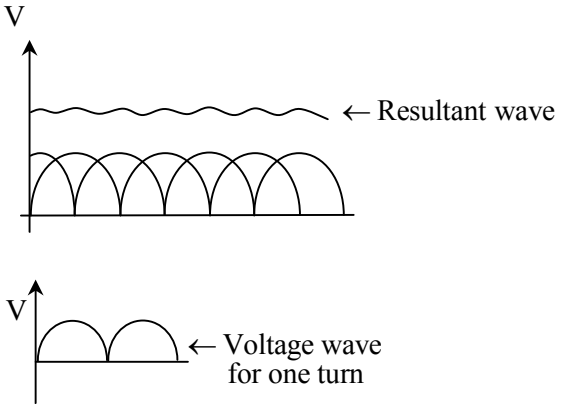
(D) Sinusoidal positive-half and zero negative, in each cycle

Key: (C)

Sol: One turn Generator



For multiple turns (Symmetrically distributed)



The Brush to brush voltage wave will have few ripples in it and is not easy to have pure (or) constant unidirectional wave in Hetropolar construction (Projected poles).

11. A 3-phase induction motor operating at a slip of 5% develops 20 kW rotor power output. What is the corresponding rotor copper loss in this operating condition?

(A) 750 W (B) 900 W

(C) 1050 W (D) 1200 W

Key: (C)

Sol: Power division in Rotor

Rotor input : Rotor copper Losses : Rotor Gross Mechanical power

$$=1 : S : (1-S)$$

Rotor Copper Los

$$=\frac{S\times \text{Rotor gross power}}{1-S}$$

$$=\frac{0.5\times 20\times 10^3}{1-0.05}=1052.631\,\text{watts}$$

12. What are the signs of load angle in an alternator during generator and motor operations, respectively?

(A) Negative, negative

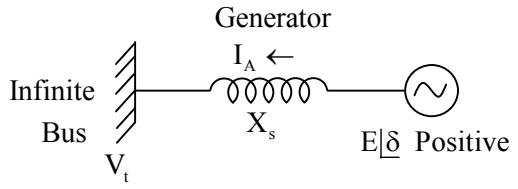
(B) Positive, negative

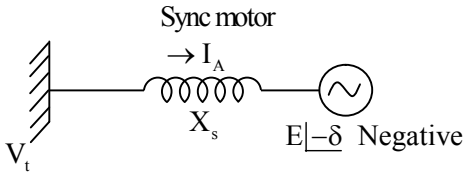
(C) Negative, positive

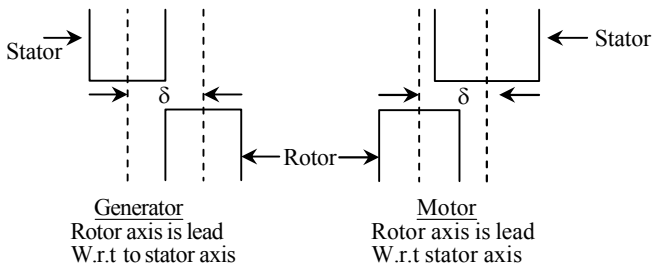
(D) Positive, positive

Key: (B)

Sol:







13. In an alternator, the armature winding is kept stationary while the field winding is kept rotating for the following reasons:

1. Armature handles very large current and high voltage
2. Armature fabrication, involving deep slots to accommodate large coils, is easy if armature is kept stationary.
3. It is easier to cool the stator than the rotor.

Which of the above reasons are correct?

(A) 1 and 2 only (B) 1 and 3 only

(C) 2 and 3 only (D) 1, 2 and 3

Key: (D)

Sol: All the statements are correct

14. Increasing the air-gap of a squirrel-cage induction motor would result in

(A) Increase in no-load speed

(B) Increase in full-load power-factor

(C) Increase in magnetizing current

(D) Maximum available torque

Key: (C)

Sol: Increase in air gap results in more reluctance and hence the motor draws large Magnetising current to set up a constant Rotating Magnetic field.

15. A cumulative compound d.c. motor runs at 1500 rpm on full load. If its series field is short circuited, its speed

(A) Becomes zero (B) Remains same

(C) Increases (D) Decreases

Key: (C)

Sol: In Cummulative compound motor, the total flux is given by

$\phi_T = \phi_{sh} + \phi_{se}$

If the series field is short circuited, then the total flux will be $\phi_T = \phi_{sh}$ i.e., reduces. Therefore speed increases.

as $\Uparrow N \propto \frac{E_b}{\phi \Downarrow}$

16. If the capacitor of a capacitor-start single-phase motor fails to open when the motor picks up speed,

(A) The motor will stop.

(B) The auxiliary winding will be damaged.

(C) The capacitor will be damaged.

(D) The winding will be damaged.

Key: (C)

Sol: If Switch fails to open then Capacitor will remain in circuit and high voltage appears across the capacitor which will damage the capacitor.

17. For a 3-phase induction motor, what fraction /multiple of supply voltage is required for a direct-on-line starting method such that starting current is limited to 5 times the full-load current and motor develops 1.5 times full-load torque at starting time?

(A) 1.632 (B) 1.226 (C) 0.816 (D) 0.456

Key: (B)

Sol: DoL starter, will not limit the starting current

$$\frac{T_{st}}{T_{FL}} = \left(\frac{I_{st}}{I_{FL}}\right)^2 S_{FL}$$

$$\sqrt{\frac{1.5T_{FL}}{T_{FL}}} = \frac{I_{st}}{I_{FL}}$$

$1.224 = I_{P.U}$

$\therefore I \propto V$

The Required supply voltage will be 1.224 i.e., 22.4% more

18. What is the material of slip-rings in an induction machine?

(A) Carbon (B) Nickel

(C) Phosphor bronze (D) Manganese

Key: (C)

Sol: 'Phosphor bronze' is used to make slip rings. Slip rings will provide the path for current from stationary device to dynamic device and Vice – Versa.

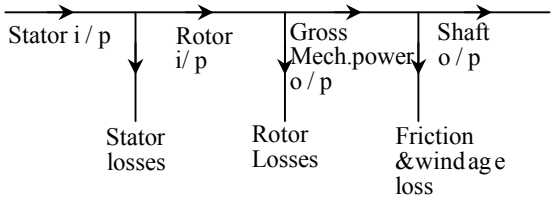
19. The stator loss of a 3-phase induction motor is 2 KW. If the motor is running with a slip of 4% and power input of 90 kW, then what is the rotor mechanical power developed?

(A) 84.48 kW (B) 86.35 kW

(C) 89.72 kW (D) 90.52 kW

Key: (A)

Sol: Power division in Induction motor



Given

$\text{Stator loss} = 2\,\text{kW}$

$\text{Stator i / p} = 90\,\text{kW}$

$\text{Slip} = 4\%$

$\text{Rotor input} = \text{Stator i / p} - \text{stator losses}$

$= 90 - 2 = 88\,\text{kW}$

Rotor Gross

$\text{Mechanical power} = (1-S)\,\text{Rotor i / p}$

$= (1-0.04)\times 88\times 10^3$

$= 84.48\,\text{kW}.$

20. In a single-phase capacitor-start induction motor, the direction of rotation.

(A) Can be changed by reversing the main winding terminals.

(B) Cannot be changed

(C) is dependent on the size of the capacitor.

(D) Can be changed only in large capacity motors.

Key: (A)

Sol: $1-\phi$ Induction motor, the direction of rotation can be changed by reversing the main winding terminals.

21. Air pollution due to smoke around a thermal power station can be reduced by installing

(A) Induced draft fan

(B) Super heater

(C) Economizer

(D) Electrostatic precipitator

Key: (D)

Sol: To collect the dust particles from the flue gases, Electrostatic precipitator is used.

22. The load curve is useful in deciding

1. The operating schedule of generating units
2. The total installed capacity

Which of the above statements is/are correct?

(A) 1 only (B) 2 only

(C) Both 1 and 2 (D) Neither 1 nor 2

Key: (C)

Sol: The load curve indicates average (KWh) energy consumption during a given period and hence it is useful in deciding both the operating schedule of generating units and the total installed capacity.

23. The maximum demand on a steam power station is 480 MW. If the annual load factor is 40%, then the total energy generated annually is

(A) 19819.2×10^5 kWh

(B) 18819.2×10^5 kWh

(C) 17819.2×10^5 kWh

(D) 16819.2×10^5 kWh

Key: (D)

Sol: $\text{Load factor} = \dfrac{\text{Average load}}{\text{Maximum demand}}$

$\text{Average load} = 0.4\times 480 = 192\,\text{MW}$

$= 192\times 10^3\,\text{kW}$

Total energy generated annually

$= 192\times 10^3\times 365\times 24$

$= 16819.2\times 10^5\,\text{kWh}$

24. To equalize the sending and receiving end voltages, impedance is connected at the receiving end of a transmission line having the following *ABCD* parameters.

$A = D = 0.9\angle 0°$ $B = 200\angle 90°\ \Omega$

The impedance so connected would be

(A) $1000\angle 0°\ \Omega$ (B) $1000\angle 90°\ \Omega$

(C) $2000\angle 90°\ \Omega$ (D) $2000\angle 0°\ \Omega$

Key: (C)

Sol: $A = D = 0.9\underline{|0^o}, B = 200\underline{|90^o}\Omega$

$$A_{eq} = A + \frac{B}{Z}$$

$$= 0.9\underline{|0} + \frac{200\underline{|90^o}}{Z}$$

As $|V_S| = |V_R|$

$$A_{eq} = 0.9\underline{|0} + \frac{200\underline{|90^o}}{Z}$$

$$I = 0.9\underline{|0} + \frac{200\underline{|90^o}}{Z}$$

$$\therefore Z = 2000\underline{|90^o}$$

25. The maximum efficiency in the transmission of bulk ac power will be achieved when the power factor of the load is

(A) Slightly less than unity lagging

(B) Slightly less than unity leading

(C) Unity

(D) Considerably less than unity

Key: (A)

Sol: For maximum power transfer condition, the load should be of leading nature.

26. A speed of a d.c. motor is

(A) Directly proportional to back emf and inversely proportional to flux

(B) Inversely proportional to back emf and directly proportional to flux

(C) Directly proportional to back emf as well as to flux

(D) Inversely proportional to back emf as well as to flux.

Key: (A)

Sol: We know, Back E.M.F $E_b = \frac{\phi PNZ}{60A}$

$E_b = \propto \phi N;$

$N \propto \frac{E_b}{\phi}$

27. When the sending end voltage and current are numerically equal to the receiving end voltage and current respectively, then the line is called

(A) A tuned line (B) A transposed line

(C) A long line (D) A short line

Key: (A)

Sol: $$\begin{bmatrix} V_S \\ I_S \end{bmatrix} = \begin{bmatrix} \cosh r\ell & z_c \sinh r\ell \\ \frac{1}{z_c}\sinh r\ell & \cosh r\ell \end{bmatrix} = \begin{bmatrix} V_R \\ I_R \end{bmatrix}$$

For an over head line, $\gamma = jw\sqrt{LC}$

$W\ell\sqrt{LC} = n\pi; n = 1, 2, 3.....$

Then $|V_S| = |V_R|$ and $|I_S| = |I_R|$

Receiving End voltage and current are numerically Equal to the corresponding sending end waves. such a line is called tuned line.

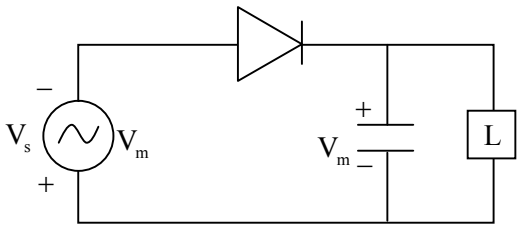
28. If V_m is the peak value of an applied voltage in a half wave rectifier with a large capacitor across the load, then the peak inverse voltage will be

(A) 0.5 V_m (B) V_m

(C) 1.5 V_m (D) 2.0 V_m

Key: (D)

Sol:



Steady state voltage across load = V_m (due to large capacitor)

PIV=$2V_m$

29. A 100 MVA generator operates on full-load of 50 Hz frequency. The load is suddenly reduced to 50 MW. The steam valve begins to close only after 0.4 s and if the value of the inertia constant H is 5 s. Then the frequency at 0.4 s is nearly

(A) 38 Hz (B) 44 Hz (C) 51 Hz (D) 62 Hz

Key: (C)

Sol: $f_n = f_0\left[\frac{H.S+(\Delta P_d).T_d}{H.S}\right]^{1/2}$

$= 50\left[\frac{100\times5+50\times0.4}{100\times5}\right]^{1/2}$

$= 51\ Hz$

30. A 25 MVA, 33 kV transformer has a *pu* impedance of 0.9. The *pu* impedance at a new base 50 MVA at 11 kV would be

(A) 10.4 (B) 12.2 (C) 14.4 (D) 16.2

Key: (D)

Sol: $Z_{pu\,new} = Z_{pu\,old}\times\frac{(MVA)_{new}}{(MVA)_{old}}\times\frac{(kV)^2_{old}}{(kV)^2_{new}}$

$= 0.9\times\frac{50}{25}\times\left(\frac{33}{11}\right)^2$

$= 16.2\ pu$

31. Symmetrical components are used in power system for the analysis of

(A) Balanced 3-phase fault

(B) Unbalanced 3-phase fault

(C) Normal power system under steady conditions

(D) Stability of system under disturbance

Key: (B)

32. For V-curves for a synchronous motor the graph is drawn between

(A) Terminal voltage and load factor

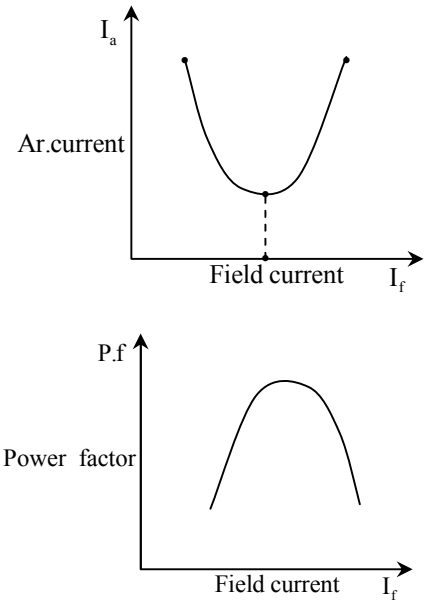
(B) Power factor and field current

(C) Field current and armature current

(D) Armature current and power factor

Key: (C)

Sol:



33. Critical clearing angle is related to

(A) Stability study of power system

(B) Power flow study of power system

(C) Regulation of transmission line

(D) Power factor improvement of the system

Key: (A)

Sol: The maximum allowable value of the clearing time and angle for the system to remain stable are known respectively as critical clearing time and angle.

34. A 2-pole, 50 Hz, 11 kV, 100 MW alternator has a moment of inertia of $10{,}000\ kg.m^2$. The value of inertia constant, H is

(A) 3.9 s (B) 4.3 s (C) 4.6 s (D) 4.9 s

Key: (D)

Sol: $M = \frac{HS}{\pi.f};\quad m = J.W_e.\left(\frac{2}{P}\right)^2$

On equating both formulas

i.e, $J.w_e.\left(\frac{2}{P}\right)^2 = \frac{HS}{\pi f}$

$10000\times(2\pi\times50)\times\left(\frac{2}{2}\right)^2 = \frac{H\times100}{\pi\times50}$

$H = 4.93s$

35. Stability of a power system can be improved by
1. Using series compensators
2. Using parallel transmission lines
3. Reducing voltage of transmission
Which of the above statements are correct?
(A) 1 only (B) 2 only
(C) 2 and 3 only (D) 1 and 2

Key: (D)

Sol: Stability of a power system can be improved by
(i) higher system voltage
(ii) use of parallel lines to reduce the series reactance.
(iii) Use of high speed circuit breakers and auto-reclosing breakers.
(iv) Reducing the series reactance thereby increasing Pm and therefore increases the transient stability limit of a system.

36. Equal-Area criterion is employed to determine
(A) The steady state stability
(B) The transient stability
(C) The reactive power limit
(D) The rating of a circuit breaker

Key: (B)

37. Consider the following advantages with respect to HVDC transmission:
1. Long distance transmission
2. Low cost of transmission
3. Higher efficiency
Which of the above advantages are correct?
(A) 1 and 2 only (B) 1 and 3 only
(C) 2 and 3 only (D) 1, 2 and 3

Key: (D)

Sol: Advantages of HVDC systems:
(i) Economical for long distance bulk power transmission by overhead lines.
(ii) Greater power per conductor and simpler line construction.
(iii) No skin effect
(iv) No reactive compensation is required.
(v) Higher operating voltage is possible
(vi) No stability problem.

38. The three sequence voltages at the point of fault in a power system are found to be equal. The nature of the fault is
(A) L – G (B) L – L – L
(C) L – L (D) L – L – G

Key: (D)

Sol: For double line to ground fault
$V_{a0} = V_{a1} = V_{a2} = V_{a3}$
Here phase b and c are shorted to ground.

39. A distance relay with inherent directional property is known as
(A) Buchholtz relay
(B) Admittance relay
(C) Directional over current relay
(D) Directional switched relay

Key: (B)

Sol: Its characteristic (Admittance relay) passes through origin of R–X diagram and hence directional.

40. Consider the following circuit breakers for 220 kV substations:
1. Air
2. SF_6
3. Vacuum
Which of the above circuit breakers can be used in an indoor substation?
(A) 1, 2 and 3 (B) 1 only
(C) 2 only (D) 3 only

Key: (C)

Sol: Air break circuit breaker : This type of circuit breaker is employed in both a.c. and d.c. type of circuits upto 12 KV. These are normally indoor type and installed on vertical panels.
Vacuum and SF6 gas circuit breakers are suitable for primary and secondary power distribution networks upto 40.5KV, 3150A, 63KA. In particular, SF6 circuit breakers do not generate operating over voltages and are suitable for retrofitting, upgrading. Indoor circuit breakers for secondary distribution

41. A semiconductor differs from a conductor in that it has
(A) Only one path for the free electrons in the valence band
(B) Only one path for holes in the conduction band
(C) Two paths followed by free electrons and holes, one an ordinary path n the conduction band and the other one an extraordinary path in the valence band, respectively.
(D) Two paths followed by free electrons and holes, one an extra-ordinary path in the conduction band and the other one an ordinary path in valence band, respectively.

Key: (C)

Sol: In a semiconductor, conduction band and valence band are separated by energy gap. At room temperature, some of the e– in V.B. gain enough energy to overcome the energy gap and move into C.B. leaving behind an empty space in V.B which is called as Hole. An e– in the V.B. may fill the hole, leaving another hole in its place. In this way, a hole appears to move. In the presence of electric field e– move in on direction and holes appear to move in the opposite direction and both contribute to conductivity of the material. Hence, e– moves in ordinary path in C.B. and holes move in extra-ordinary path in V.B.

42. Which of the following circuit is used for converting a sine wave into a square wave?
(A) Monostable multivibrator
(B) Bistable multivibrator
(C) Schmitt trigger circuit
(D) Darlington complementary pair

Key: (C)

43. What is the type of breakdown that occurs in a Zener diode having breakdown voltage (bV)?
(A) Avalanche breakdown only
(B) Zener breakdown only
(C) Avalanche breakdown where breakdown voltage is below 6 V and Zener breakdown otherwise.
(D) Zener breakdown where breakdown voltage is below 6V and Avalanche breakdown otherwise.

Key: (D)

Sol: Zener breakdown occurs due to high doping concentrations which usually occurs at a voltage less than 6 V. Avalanche breakdown is a cumulative multiplication process which occurs at moderate doping concentrations with a voltage greater than 6 V.

44. Consider the following statements:
A power supply uses bridge rectifier with a capacitor input filter. If one of the diodes is defective, then
1. The dc load voltage will be lower than its expected value
2. Ripple frequency will be lower than its expected value
3. The surge current will increase considerably.

Which of the above statements are correct?
(A) 1 and 2 only (B) 1 and 3 only
(C) 2 and 3 only (D) 1, 2 and 3

Key: (D)

45. The lowest frequency of ac components in the outputs of half-wave and full-wave rectifiers are, respectively, (where ω is the input frequency)
(A) 0.5ω and ω (B) ω and 2ω
(C) 2ω and ω (D) ω and 3ω

Key: (B)

46. A half-wave rectifier circuit using ideal diode has an input voltage of 20 sin ωt volt. Then

average and rms values of output voltage respectively, are

(A) $\frac{10}{\pi}$ V and 5V (B) $\frac{20}{\pi}$ V and 10V

(C) $\frac{20}{\pi}$ V and 5V (D) $\frac{10}{\pi}$ V and 10V

Key: (B)

Sol: $V_i = 20\sin\omega t;\ V_m = 20V$

$$V_{ave} = \frac{V_m}{\pi} = \frac{20}{\pi}V$$

$$V_{rms} = \frac{V_m}{2} = \frac{20}{2} = 10V$$

47. For a BJT, $I_C = 5$ mA, I_B=*50* μA and $I_{CBO} = 0.5$ μA, then the value of β is

(A) 99 (B) 91 (C) 79 (D) 61

Key: (A)

Sol: **Given**

$I_c = 5mA;\ I_B = 50\mu A;\ I_{CBO} = 0.5\mu A;\ \beta = \_\_\_\_$

$$I_c = \beta I_B + (1+\beta) I_{CBO}$$

$$5\times10^{-3} = \beta\times50\times10^{-6} + (1+\beta)\times0.5\times10^{-6}$$

$$\beta = 99$$

48. Which of the following conditions must be satisfied for a transistor to be in saturation?

1. Its collector to base junction should be under forward bias
2. Its collector to base junction should be under reverse bias
3. Its emitter to base junction should be under reverse bias
4. Its emitter to base junction should be under forward bias

Which of the above conditions are true?

(A) 1 and 3 (B) 2 and 3

(C) 2 and 4 (D) 1 and 4

Key: (D)

Sol: For a transistor to be in saturation region its emitter-base junction and collector-base junction must be forward biased.

49. In an amplifier with a gain of 1000 without feedback and cut-off frequencies at 2 kHz and 20 kHz, negative feedback of 1% is employed. The cut-off frequencies with feedback would be

(A) 220 Hz and 22 kHz

(B) 182 Hz and 220 kHz

(C) 220 kHz and 220 kHz

(D) 182 Hz and 22 kHz

Key: (B)

Sol: Given A = 1000; f_L=2 kHz; f_H=20 kHz

$\beta = 0.01;\ f_{Lf} = \_\_\_\_;\ f_{Hf} = \_\_\_\_$

$$f_{Lf} = \frac{f_L}{1+A\beta} = \frac{2000}{1+1000\times0.01} = 182\,Hz$$

$$f_{Hf} = (1+A\beta) f_H = (1+1000\times0.01)\times20\times10^3$$

$$= 220\,kHz$$

50. Consider the following circuits:

1. Oscillator
2. Emitter follower
3. Power amplifier

Which of the above circuits employ feedback?

(A) 1 and 2 only (B) 2 and 3 only

(C) 1 and 3 only (D) 1, 2 and 3

Key: (A)

51. Three identical amplifiers each having a voltage gain of 50 are cascaded. The open loop voltage gain of the combined amplifier is

(A) 71 dB (B) 82 dB (C) 91 dB (D) 102 dB

Key: (D)

Sol: A_v = Voltage gain of each amplifier = 50

Open loop gain of the combined amplifier = $20\log_{10}(50)^3 = 102\,dB$

52. A clamper circuit

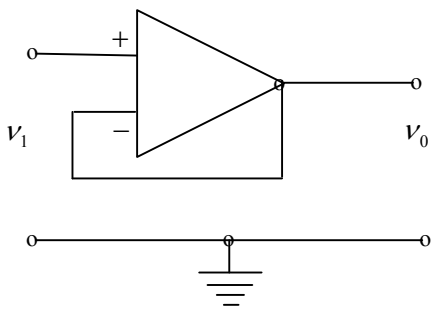
1. Adds or subtracts a dc voltage to or from a waveform
2. Does not change the shape of the waveform

Which of the above statements is/are correct?

(A) 1 only (B) 2 only
(C) Both 1 and 2 (D) Neither 1 nor 2

Key: (C)

53.



The operational amplifier circuit shown in figure having a voltage gain of unity has
(A) High input impedance and high output impedance
(B) High input impedance and low output impedance
(C) Low input impedance and low output impedance
(D) Low input impedance and high output impedance

Key: (B)

54. Consider the following statements:
1. Race-around condition occurs in a JK flip-flop when the inputs are 1, 1
2. A flip-flop is used to store one bit of information
3. A transparent latch consists of D-type flip-flops
4. Master-slave configuration is used in a flip-flop to store two bits of information.

Which of the above statements are correct?
(A) 1,2 and 3 only (B) 1,2 and 4 only
(C) 3 and 4 only (D) 1,2,3 and 4

Key: (A)

Sol: Race around condition is avoided using master-slave configuration .It does not store two bits of information. Remaining statements are correct.

55. An operational amplifier has a slew rate of $2V/\mu$ sec. If the peak output is 12 V, what will be the power bandwidth?
(A) 36.5 kHz (B) 26.5 kHz
(C) 22.5 kHz (D) 12.5 kHz

Key: (B)

Sol: Given $S = \text{slew rate} = 2V/\mu\text{sec}$

$V_{peak} = 12V$

$f_{max} = \text{power bandwidth} = \_\_\_$

Maximum slew rate $= 2\pi f_{max} \times V_{peak}$

$$f_{max} = \frac{s}{2\pi V_{peak}} = \frac{2\times10^6}{2\pi\times12} = 26.5\,\text{kHz}$$

56. A voltage follower is used as
1. An isolation amplifier
2. A buffer amplifier

Which of the above statements is/are correct?
(A) 1 only (B) 2 only
(C) Both 1 and 2 (D) Neither 1 nor 2

Key: (C)

57. If *a, b, c* are 3-input variable, then Boolean function $y = ab + bc + ca$ represents
1. A 3-input majority gate
2. A 3-input minority gate
3. Carry output of a full adder
4. Product circuit for *a, b,* and *c*

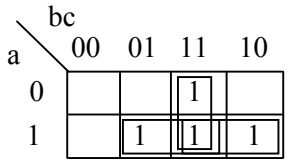
Which of the above statements are correct?
(A) 2 and 3 (B) 2 and 4
(C) 1 and 3 (D) 1 and 4

Key: (C)

Sol: In the given input combination if the majority of inputs are 1, then the Boolean (SOP) function gives a majority gate
In the given 3-input a,b,c if atleast two inputs are '1' then the Boolean function
$y = ab + bc + ca$ represent majority gate.
Consider the truth table of full adder.

a	b	c	sum	carry
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

By using K- map method the carry output is obtained as follows:



carry = ab + bc + ca

Thus the given Boolean function represents carry o/p of a full adder.

58. In a 2-input CMOS logic gate, one input is left floating i.e. connected neither to ground nor to a signal. What will be the state of that input?

(A) 1 (B) 0

(C) Same as that of the other input

(D) Indeterminate (neither 1 nor 0)

Key: (D)

59. The expression for MOD number for a ripple counter with N flip-flops is

(A) N (B) 2^N (C) 2^{N-1} (D) $2^N - 1$

Key: (B)

Sol: A ripple counter with N flipflops can count 2^N i.e., from 0 to (2^N-1) and the count repeats.

60. Why a ROM does not have data inputs?

(A) It does not have a WRITE operation

(B) Data inputs are integrated with data outputs

(C) Data inputs are integrated with address inputs

(D) ROM is sequentially accessed

Key: (A)

Sol: In ROM, we can do only Read no multiple write, so data inputs is not required.

61. Consider the following statements:

1. RAM is a non-volatile memory whereas ROM is a volatile memory
2. RAM is a volatile memory whereas ROM is a non-volatile memory
3. Both RAM and ROM are volatile memories but in ROM data is not saved, when power is switched off.

Which of the above statements are correct?

(A) 1 only (B) 2 only

(C) 3 only (D) None of the above

Key: (B)

Sol: → ROM is a non-volatile memory

→ Where as RAM is volatile memory.

62. Consider the following instructions:

1. LOCK
2. STD
3. HLT
4. CLI

Which of the above are machine control instructions?

(A) 1 and 4 (B) 1 and 3

(C) 2 and 3 (D) 2 and 4

Key: (B)

Sol: Lock and HLT are machine control instructions in 8086 micro-processor, where as STD ad CLT are flag manipulation instructions.

63. What is the assembler directive statement used to reserve an array of 100 words in memory and initialize all 100 words with 0000 and give it a name STORAGE?

(A) STORAGE DW 100

(B) STORAGE DW 100 DUP (0)

(C) STORAGE DW 100 DUP (?)

(D) STORAGE DB 100

Key: (B)

Sol: Reserve an array of 100 words of memory and initialize all 100 words with 0000. Array is named as: STORAGE DW 100 DUP(0)

64. Consider the following statements:
1. Auxiliary carry flag is used only by the DAA and DAS instructions
2. Zero flag is set to 1 if the two operands compared are equal
3. All conditional jumps are long-type jumps

Which of the above statements are correct?
(A) 1,2 and 3 only (B) 1 and 2 only
(C) 1 and 3 only (D) 2 and 3 only

Key: (B)

65. If a 3-phase slip ring induction motor is fed from the rotor side with stator winding short circuited, then frequency of currents flowing in the short circuited stator is
(A) Slip x frequency
(B) Supply frequency
(C) Frequency corresponding to rotor speed
(D) Zero

Key: (A)

Sol: By means of Mutual induction and to satisfy lenz's law the frequency of e.m.f. in stator will be $s \times$ frequency.

66. The reversing of a 3ϕ induction motor is achieved by
(A) $Y-\Delta$ starter (B) DOL starter
(C) Auto transformer
(D) Interchanging any two of the supply line

Key: (D)

Sol: To Reverse the direction of rotation of motor $(3-\phi)$. It is suggested to Change or Reverse any two phases. If we reverse the supply phases, the current through the respective windings will be reversed and hence the production of flux, torque/force on the conductor will be reversed.

67. Consider the following interrupts for 8085 microprocessor:
1. INTR
2. RST 5.5
3. RST 6.5
4. RST 7.5
5. TRAP

If the interrupt is to be vectored to any memory location then which of the above interrupts is/are correct?
(A) 1and 2 only (B) 1,2,3 and 4
(C) 5 only (D) 1 only

Key: (D)

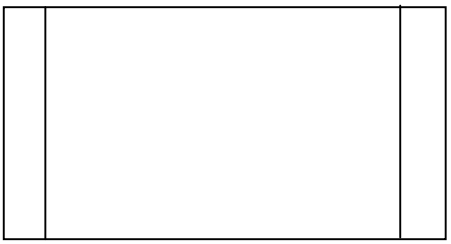
Sol: By the use of external hardware, the address of Interrupt service routine (ISR) is generated for INTR interrupt for remaining interrupts their ISR address is fixed.

68. The instruction JNC 16 bit refers to Jump to 16 bit address if
(A) Sign flag is set (B) CY flag is reset
(C) Zero flag is set (D) Parity flag is reset

Key: (B)

Sol: JNC 16-bit address refers to jump to specified address if carry flag is reset.

69. Consider the symbol shown below:



What function does the above symbol represent in a program flow chart?
(A) A process (B) Decision making
(C) A subroutine (D) Continuation

Key: (C)

Sol: Double sided rectangle represents a predefined process such as a subroutine.

70. Which one of the following statements is correct regarding the instruction CMP A?
(A) Compare accumulator with register A
(B) Compare accumulator with memory
(C) Compare accumulator with register H
(D) This instruction does not exist

Key: (A)

Sol: CMP A → Compare the content of accumulator with register A.

71. The instruction RET executes with the following series of machine cycle
(A) Fetch, read, write
(B) Fetch, write, write
(C) Fetch, read, read
(D) Fetch, read

Key: (C)

Sol: RET will execute in the order of Fetch cycle, read cycle and read cycle

72. Consider the following circuits:
1. Full adder
2. Half adder
3. JK flip-flop
4. Counter

Which of the above circuits are classified as sequential logic circuits?
(A) 1 and 2 (B) 3 and 4
(C) 2 and 3 (D) 1 and 4

Key: (B)

Sol: Full adder and Half adder circuits are combinational circuits. JK flip-flop and counter are sequential circuits.

73. When a peripheral is connected to the Microprocessor in Input Output mode, the data transfer takes place between
(A) Any register and I/O device
(B) Memory and I/O device
(C) Accumulator and I/O device
(D) HL register and I/O device

Key: (C)

Sol: When microprocessor works in I/O mode then data transfer takes place between accumulator register of micro processor and I/O device.

74. While execution of IN/OUT instruction takes place, the 8-bit address of the port is placed on
(A) Lower address bus
(B) Higher address bus
(C) Data bus
(D) Lower as well as higher order address bus

Key: (D)

Sol: While execution of IN/OUT instruction, the 8-bit port address is placed on lower address bus as well as higher address bus.

75. The port C of 8255 can be configured to work in
(A) mode 0, mode 1, mode 2 and BSR
(B) mode 0, mode 1 and mode 2
(C) mode 2 and BSR
(D) BSR mode only

Key: (A)

Sol: Port C of 8255 can be configured to work in mode 0, mode 1, mode 2 and BSR (Bit set/Reset)

76. Consider the following statements:
1. Semiconductor memories are organized as linear array of memory locations
2. To address a memory location out of N memory locations, at least log N bits of address are required.
3. 8086 can address 1,048,576 addresses
4. Memory for an 8086 is set up as two banks to make it possible to read or write a word with one machine cycle.

Which of the above statements are correct?
(A) 1, 2 and 3 only (B) 1, 2 and 4 only
(C) 3 and 4 only (D) 1, 2, 3 and 4

Key: (C)

77. The sticker over the EPROM window protects the chip from
(A) Infrared light from sunlight
(B) UV light form fluorescent lights and sunlight
(C) Magnetic field
(D) Electrostatic field

Key: (B)

78. A 2400 / 240 V, 200 kVA, single phase transformer has a core loss of 1.8 kW at rated voltage. Its equivalent resistance is 1.1%. Then the transfer efficiency at 0.9 power factor and on full load is
(A) 95.60% (B) 96.71%
(C) 97.82% (D) 98.93%

Key: (C)

Sol: $\eta_{FL} = \dfrac{xE_2I_2\cos\phi_2}{xE_2I_2\cos\phi_2 + W_i + x^2W_{cu}}$

$\%W_{Fl} = \dfrac{I_2^{\,2}\times R_2}{E_2I_2}$

$= \dfrac{1\times 200\times 0.9}{1\times 200\times 0.9 + 1.8 + (1)^2\times 2.2}$

$W_{Fl} = \dfrac{1.1}{100}\times 200 = 97.82\%$

79. The 8259A programmable interrupt controller in cascade mode can handle interrupts of
(A) 8 priority levels (B) 16 priority levels
(C) 32 priority levels (D) 64 priority levels

Key: (D)

Sol: The 8259A interrupt can be expanded to 64 priority levels by cascading additional 8259As.

80. 8259A programmable Interrupt controller uses the following initialization commands:
1. ICW_1
2. ICW_2
3. ICW_3
4. ICW_4

If 8259A is to be used in cascaded and fully nested mode, the ICW_1 bits D_0 and D_1 are
(A) 0 and 0 (B) 1 and 0
(C) 0 and 1 (D) 1 and 1

Key: (C)

81. The induced emf in the armature conductor of D.C. machine is
(A) Sinusoidal (B) Trapezoidal
(C) Rectangular unidirectional
(D) Triangular

Key: (A)

Sol: The Induced EMF in armature Conductor is always alternating nature in D.C and A.C machines
i.e. sinusoidal nature

82. If a carrier of 100% modulated AM is suppressed before transmission, the power saving is nearly.
(A) 50% (B) 67% (C) 100% (D) 125%

Key: (B)

Sol: Total power with carrier,

$P_T = P_C\left(1+\dfrac{m^2}{2}\right)$; m = modulation index = 1

If carrier is suppressed then power will be

$P_l = P_c\dfrac{m^2}{2}$

Power saving $= \dfrac{\text{Powersaved}}{\text{Total power}} = \dfrac{P_T - P_l}{P_T}$

$= \dfrac{P_c\left(1+\dfrac{m^2}{2}\right) - P_c\dfrac{m^2}{2}}{P_c\left(1+\dfrac{m^2}{2}\right)}$

$= \dfrac{P_c + P_c.\dfrac{m^2}{2} - P_c\dfrac{m^2}{2}}{P_c\left(1+\dfrac{m^2}{2}\right)}$

$$= \frac{2}{2+m^2} = \frac{2}{2+1} = \frac{2}{3} = 0.67 = 67\%$$

83. An FM signal is represented by $v = 12\sin(6\times10^8 t + 5\sin 1250t)$. The carrier frequency f_c and frequency deviation δ, respectively, are
(A) 191 MHz and 665 Hz
(B) 95.5 MHz and 995 Hz
(C) 191 MHz and 995 Hz
(D) 95.5 MHz and 665 Hz

Key: (B)

Sol: $V=12 \sin (6\times10^8 t + 5\sin 1250t)$

Comparing with standard FM signal

$s(t) = A_c \sin(w_c t + \beta \sin w_m t)$

$w_c = 6\times10^8$

$w_c = 2\pi f_c$

$\therefore f_c = \frac{6\times10^8}{2\pi} = 95.54\,MHz$

$\beta = 5;\ \omega_m = 1250$

$\therefore f_m = \frac{1250}{2\pi} = 199\,Hz.$

$\therefore \beta = \frac{\text{frequency division}}{\text{message frequency}} = \frac{\delta}{f_m}$

$\therefore \delta = \beta \times f_m = 5\times199 = 995\,Hz$

84. When the modulating frequency is doubled the modulation index is halved and the modulating voltage remains constant. This happens when the modulating system is
(A) AM (B) PM
(C) FM (D) Delta Modulation

Key: (C)

85. $v = A\sin(\omega_c t + m\sin\omega_m t)$ is the expression for
(A) Amplitude modulated signal
(B) Frequency modulated signal
(C) Phase modulated signal
(D) Carrier signal used for modulation

Key: (C)

86. The four basic elements in a PPL are loop filter, loop amplifier, VCO and
(A) Up converter
(B) Down converter
(C) Phase converter
(D) Frequency multiplier

Key: (C)

87. In a frequency modulated (FM) system, when the audio frequency is 500 Hz and audio frequency voltage is 2.4 V, the frequency deviation δ is 4.8 kHz. If the audio frequency voltage is now increased to 7.2 V then what is the new value of deviation?
(A) 0.6 kHz (B) 3.6 kHz
(C) 12.4 kHz (D) 14.4 kHz

Key: (D)

Sol: $f_m = 500Hz,\ Am = 2.4V, \delta = 4.8\,kHz$

frequency deviation, $\delta = K_f . A_m$

$\therefore K_f = \frac{\delta}{A_m} = \frac{4.8}{2.4}\times10^3\,Hz/V$

$= 2\times10^3\,Hz/V$

Now $A_m^{'} = 7.2V$

$\therefore \delta' = K_f . A_m^{'}$

$\delta' = 2\times10^3 \times 7.2 = 14.4\,kHz.$

88. Modulation is used to
1. Separate different transmissions
2. Reduce the bandwidth requirement
3. Allow the use of practicable antennas
4. Ensure that intelligence may be transmitted over long distances

Which of the above statements are correct?
(A) 1, 2 and 3 only (B) 1, 3 and 4 only
(C) 2 and 4 only (D) 1, 2, 3 and 4

Key: (B)

89. Carson's rule is (with symbols having their standard meaning)

(A) $B = 2\ DW$ (B) $B = 2(D+1)W$

(C) $B = \sqrt{2}(D+1)W$ (D) $B = \sqrt{2}\ DW$

Key: (B)

90. Consider the following features of FM vis-a-vis AM:

1. Better noise immunity is provided
2. Lower bandwidth is required
3. The transmitted power is better utilized
4. Less modulating power is required

Which of the above are advantages of FM over AM?

(A) 1,2 and 3 only (B) 1,3 and 4 only

(C) 2 and 4 only (D) 1,2,3 and 4

Key: (B)

91. The ideal characteristic of a stabilizer is

(A) Constant output voltage with low internal resistance

(B) Constant output current with low internal resistance

(C) Constant output voltage with high internal resistance

(D) Constant internal resistance with variable output voltage

Key: (A)

92. For a d.c. shunt generator to self excite, the conditions to be satisfied are that there must be some residual magnetism in the field magnet, it must be in the proper direction and the shunt field resistant must be

(A) Above the critical field

(B) Equal to the critical field resistance

(C) Less than the armature resistance

(D) Less than the critical field resistance

Key: (D)

Sol: Conditions to build up voltage

i. Residual Magnetic field

ii. $F_1 - A_1$ and $F_2 - A_2$ should be connected to same polarities

iii. Total field resistance should be less than critical resistance.

iv. Speed of rotor should be greater than critical speed.

93. In an IGBT cell the collector and emitter are respectively

(A) n and p (B) n^+ and p^+

(C) p and n (D) p^+ and n^+

Key: (D)

94. The main units in a pulse code modulator are:

1. Sampler
2. Quantiser
3. Encoder
4. Comparator

(A) 1 and 2 only (B) 2 and 3 only

(C) 1,2 and 3 only (D) 2 and 4 only

Key: (C)

95. The reverse recovery time of a diode is 3 μs rate of fall $\left(\frac{di}{dt}\right)$ is $30\,A/\mu s$. The stored charge of the diode is

(A) 45 μC (B) 135 μC

(C) 270 μC (D) 540 μC

Key: (B)

Sol: $t_{rr} = \sqrt{\frac{2Q_{rr}}{\frac{di}{dt}}}$

$3^2 = \frac{2 \times Q_{rr}}{30}$

$9 \times 15 = Q_{rr}$

$Q = 135\,\mu C$

96. NAND and NOR gates are called 'Universal' gates primarily because

(A) They are available everywhere

(B) They are widely used in I.C. packages

(C) They can be combined to produce AND, OR, NOR gate.

(D) They can be manufactured easily.

Key: (C)

Sol: Any Boolean expression (or) any logic circuit can be realized with 'NAND' & 'NOR' gates. Thus the gates are called universal Gates.

97. If a medium transmission line is represented by nominal T, the value of B of ABCD constant is

(A) Z (B) $Y\left(1+\frac{1}{4}YZ\right)$

(C) $Z\left(1+\frac{1}{4}YZ\right)$ (D) $\left(1+\frac{1}{2}YZ\right)$

Key: (C)

Sol: $\begin{bmatrix} A & B \\ C & D \end{bmatrix} = \begin{bmatrix} 1+\frac{yz}{2} & z\left(1+\frac{yz}{4}\right) \\ y & 1+\frac{yz}{4} \end{bmatrix}$

$A = D$

$C = Y$

98. To turn-off a GTO what is required at the gate?

(A) A high amplitude (but low energy) negative current

(B) A low amplitude negative current

(C) A high amplitude negative voltage

(D) A low amplitude negative voltage

Key: (A)

99. A chopper circuit is operating on TRC control mode at a frequency of 2 kHz on a 230 V dc supply. For output voltage of 170 V, the conduction and blocking periods of a thyristor in each cycle are respectively.

(A) 0.386 ms and 0.114 ms

(B) 0.369 ms and 0.131 ms

(C) 0.390 ms and 0.110 ms

(D) 0.131 ms and 0.369 ms

Key: (B)

Sol: $f = 2\,kHz$

$T = \frac{1}{f} = 500\,sec$

$V_s = 230V$

$V_0 = 170V$

$V_0 = D.V_S$

$D = \frac{V_0}{V_s} = \frac{170}{230} = 0.7391$

$t_{on} = D.T = 369.56\,sec = 0.369\,msec$

$t_{off} = T - t_{on} = 130.43\,sec = 0.131\,msec$

100. A switched-capacitor network is/are

1. Time variant sample data network
2. Non linear network
3. Linear time invariant network

(A) 1 only (B) 2 only

(C) 3 only (D) 1 and 2

Key: (A)

101. A transformer may have negative voltage regulation if the load power factor (p.f.) is

(A) Leading for some values of p.f.

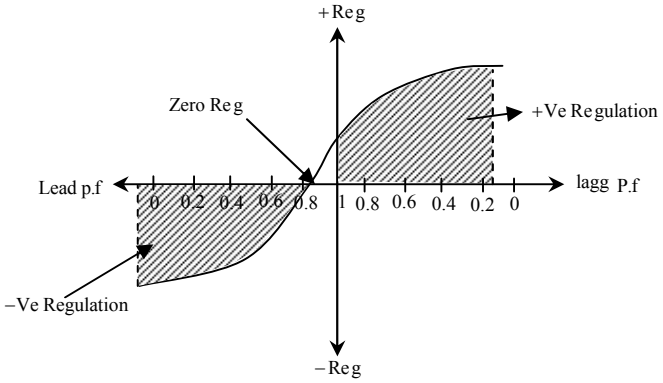
(B) Unity p.f.

(C) Lagging but not zero p.f.

(D) Only zero p.f. lag

Key: (A)

Sol: Voltage Regulation Graph.



102. Current source inverters are suitable for supplying power to

(A) R – L Loads (B) Inductive loads

(C) All loads (D) Capacitive loads

Key: (D)

103. The main application of multilevel inverter is in
(A) Reactive power compensation
(B) D.C. motor drive
(C) Synchronous Buck-converter
(D) Voltage regulator
Key: (A)

104. In a 3-phase inverter with 180° conduction mode the number of switches that is on at any instant of time is
(A) 1 (B) 2 (C) 3 (D) 4
Key: (C)

105. In the sinusoidal pulse-width modulation scheme, if the zero of the triangular wave coincides with the zero of the reference sinusoidal, then the number of pulses per half cycle is
(A) $\frac{f_c}{2f}$ (B) $\frac{f_c}{2f}+1$ (C) $\frac{2f_c}{f}$ (D) $\frac{f_c}{2f}-1$
Key: (D)
Sol: Where f_c is the frequency of the carrier wave and f is the frequency of the sinusoidal.

Directions:
Each of the next **fifteen (15)** items consist of two statements, one labeled as the 'Statement (I)' and the other as 'Statement (II)'. Examine these two statements carefully and select the answers to these items using the codes given below:
Codes:
(A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I).
(B) Both Statement (I) and statement (II) are individually true and Statement (II) is not the correct explanation of statement (I).
(C) Statement (I) is true but Statement (II) is false.
(D) Statement (I) is false but Statement (II) is true.

106. Statement (I): The armature structures of all rotating machines are laminated in order to reduce the eddy-current losses.
Statement (II): The armature windings of both D.C and A.C machines have to deal with alternating currents only.
Key: (A)
Sol: Since alternating Currents produces an alternating flux and hence E.M.F will be induced, which drives Eddy currents.
To reduce Eddy currents losses, we prefer lamination.
Note: A Constant Flux never results in E.M.F. So no need of lamination.

107. Statement (I): The electro-mechanical energy conversion principles are developed with the 'field energy', being magnetic or electric, as the basis.
Statement (II): This approach can deal with only the steady-state analysis of the electro-mechanical energy conversion, but not the transient-state analysis.
Key: (C)

108. Statement (I): A Direct-On-Line (DOL) starter for starting dc motor is used for reasons of economy.
Statement (II): DOL starter limits the starting current to a safe limit.
Key: (C)

109. Statement (I): For constant applied voltage to its terminals, the effect of armature resistance in the operation of a dc shunt motor, is to reduce the operating speed, and cause a 'drooping' speed Vs. load characteristic.
Statement (II): The effect of armature demagnetization with the decreasing load is to reduce the drop in operating speed, and can be

designed to give a 'rising' speed Vs load characteristic which may result in a possible 'runaway'.

Key: (C)

Sol: For a DC shunt motor, the speed equation is

$$\omega_m = \frac{V_t - I_a R_a}{K_a \phi} = \frac{V_t}{K_a \phi} - \frac{I_a R_a}{K_a \phi}$$

$$\omega_m = \omega_{mo} - \frac{I_a R_a}{K_a \phi}$$

So effect of Armature resistance (R_a) is to reduce the overall speed or produce drop.

However, with the reduction in load current (I_a), the factor $I_a R_a$ will reduce which will produce lesser drop.

For $I_a=0$, $\omega_m = \omega_{mo}$. So at no value of I_a , $\omega_m \neq \omega_{mo}$. It implies that speed will not be more than no load speed at any time.

Statement I is correct

Statement II is false

110. Statement (I): Synchronous motor is a constant speed motor.

Statement (II): Synchronous motor is not a self-starting motor.

Key: (B)

111. Statement (I): A synchronous motor can be used as an active device to improve the power factor of a power system.

Statement (II): By over-excitation the synchronous machine would operate as a capacitor.

Key: (A)

112. Statement (I): Stability of a power system can be improved by using parallel transmission lines.

Statement (II): Two transmission lines in parallel will increase the impedance between sending end and receiving end compared to single line.

Key: (C)

Sol: Parallel transmission line are used to enhance stability as it reduces the series reactance and increase stability margin

$$P = \frac{V_1 V_2}{X} \sin\delta$$

As x (Reactance) is decreases power increases and so is the stability margin.

113. Statement (I): When all inputs of a NAND gate are shorted to get a single input, single output gate, it becomes an inverter.

Statement (II): When all inputs of a NAND gate are at logic '0' level, the output is at logic '0' level.

Key: (D)

114. Statement (I): XOR gate is not a universal gate.

Statement (II): It is not possible to realize all Boolean functions using XOR gates only.

Key: (A)

Sol: If any Boolean function can be realized with a gate then it is called universal Gate. NAND, NOR are universal gates. But XOR is not an universal gate.

115. Statement (I): READY is an output signal used to synchronize slower peripheral.

Statement (II): HOLD is activated by an external signal.

Key: (D)

Sol: → READY is an input signal used to synchronize slower peripheral.

→ HOLD is also an input signal activated by an external signal.

116. Statement (I): The direct memory access or DMA mode of data transfer is the fastest among all the modes of data transfer.

Statement (II): In DMA mode the device directly transfers data to/from memory without interference from CPU.

Key: (A)

117. Statement (I): Modulation index of AM is always kept less than 1.
Statement (II): Modulation index of FM may be greater than 1.

Key: (B)

118. Statement (I): The main function of a freewheeling diode in rectifier circuits is to prevent the reversal of load voltage.
Statement (II): The freewheeling diode is never connected across the load.

Key: (C)

119. Statement (I): In sinusoidal pulse width modulation, width of each pulse is varied in proportion to amplitude of a sine-wave evaluated at the centre of the same pulse.
Statement (II): The rms value of output voltage can be varied by varying the modulation index.

Key: (B)

120. Statement (I): Equal-area criterion can be used to determine the stability of single machine infinite bus system.
Statement (II): An infinite bus system has infinite inertia and constant voltage.

Key: (B)

Sol: Equal area criteria is used to find out stability of single machine or two machine system
There is no need to solve non-linear differential swing equation to determine stability.
The property of infinite bus are the very basis of determining stability using equal area criteria.
So, statement (II) explains statement (I)