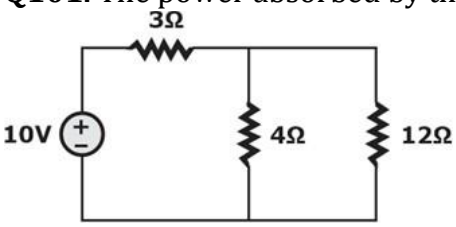
BTSC JE electrical Sample Paper

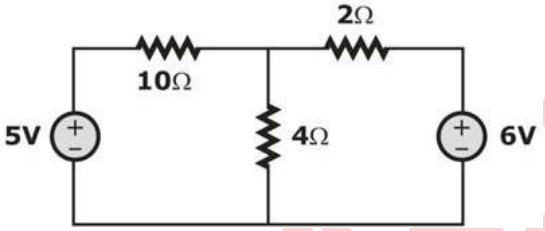
Q101. The power absorbed by the 3Ω resistor in the circuit given below is



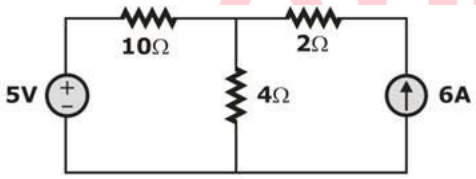
(a) 833W
(b) 83.3 W
(c) 5 W
(d) 8.33 W

Q102. To get 230 V from three phase 20 KV / 400 V supply transformer, the three windings of its secondary side should be connected in
(a) Delta
(b) Parallel
(c) Star
(d) Series

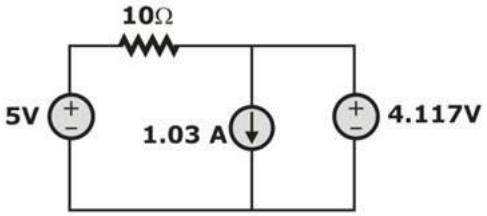
Q103. Which circuit is equivalent to the circuit shown in figure?



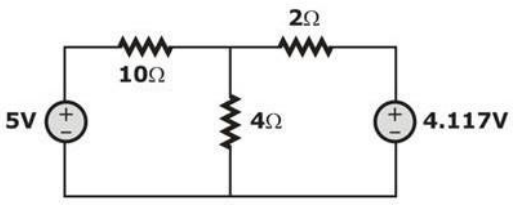
(a)



(b)

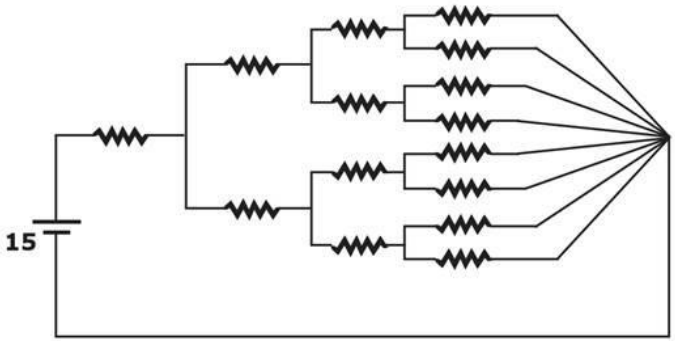


(c)



(d) Both (b) and (c)

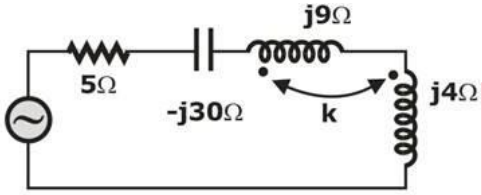
Q104. What is the current supplied by 15 V source when each resistance is 2 ohm?



(a) 4A
(b) 2A
(c) 1A
(d) 3A

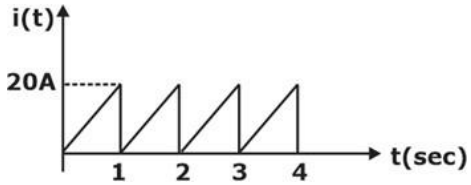
Q105. What will be the instantaneous value of alternating voltage (in V) which is represented by v(t) = 50 sin (13t – 20) V, when the value of t is 5 sec
(a) 25 V
(b) 14.14 V
(c) 353.5 V
(d) 35.35 V

Q106. What is the coefficient of coupling in the given circuit for series resonance ?



(a) 0.4
(b) 1.416
(c) 0.8
(d) Resonance can't be achieved

Q107. A current waveform is shown below, if it is fed to an ac ammeter, what is the reading shown by the meter?



(a) 20.2 A
(b) 6.65 A
(c) 14.14 A
(d) 11.54 A

Q108. Which of the following theorems can be applied to any network linear or non-linear, active or passive, time variant or time invariant?
(a) Norton theorem
(b) Thevenin theorem
(c) Tellegen theorem
(d) Superposition theorem

Q109. In a series RLC circuit, if $X_C > X_L$, then the
(a) Current and voltage will be in phase
(b) Supply voltage will lead the current
(c) Current will be zero
(d) Current will lead the supply voltage

Q110. The SI unit of conductance is:
(a) Coulomb
(b) Ohm
(c) Siemens
(d) Newton

Q111. Which of the law states that in any closed circuit the current is directly proportional to the voltage, provided the physical conditions of the circuit are kept constant?
(a) Current law
(b) Voltage law
(c) Kirchhoff's law
(d) Ohm's law

Q112. The potential inside a charged hollow sphere is
(a) Zero
(b) Same as that on the surface
(c) Less than that on the surface
(d) None of the above

Q113. Paramagnetic materials have relative permeability
(a) Slightly less than unity
(b) Slightly more than unity
(c) Equal to unity
(d) Equal to that of ferromagnetic materials

Q114. Which of the following statements is true about magnetic lines of force?
(a) Magnetic lines of force are always closed.
(b) Magnetic lines of force always intersect each other.
(c) Magnetic lines of force tend to crowd far away from the poles of the magnet.
(d) Magnetic lines of force do not pass through the vacuum.

Q115. The RMS value of a half – wave rectified alternating current is 20A. its value for full-wave rectification will be: -

(a) $\frac{40}{\pi}$ A

(b) $\frac{80}{\pi}$ A

(c) $\frac{40}{\sqrt{2}}$ A

(d) 40 A

Q116. The energy used by a 2kW electric iron in 10 minutes is

(a) 120 kJ

(b) 12 kJ

(c) 1200 kJ

(d) 1.2 kJ

Q117. In a capacitor, if the area of overlap of the plates is four times, then the capacitance will be-

(a) Half

(b) Double

(c) Four times

(d) No change

Q118. What is the field (H) due to toroid having N turns and length ℓ carrying a filamentary current I?

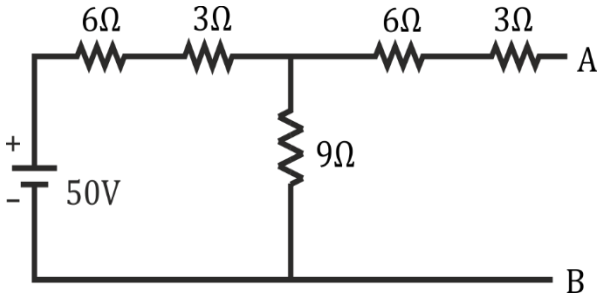
(a) $H = NI\ell$

(b) $H = \frac{NI}{\ell}$

(c) $H = \frac{\ell}{NI}$

(d) $H = \frac{NI^2}{\ell}$

Q119. What will be the Norton's Resistance (in Ω) Between terminal A and B for the given electrical circuit.



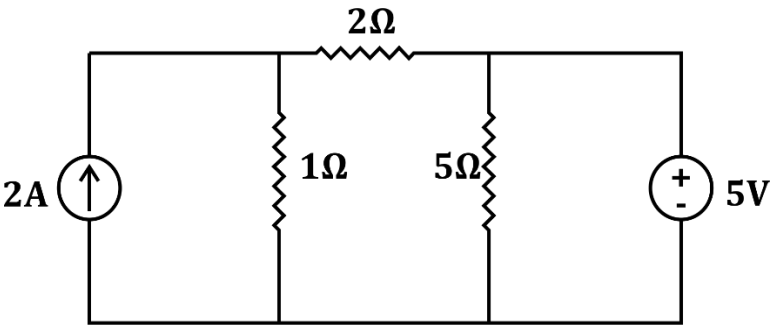
(a) 2.6 Ω

(b) 7.9 Ω

(c) 13.5 Ω

(d) 15.4 Ω

Q120. Determine the current through the 5Ω resistor in the figure given below utilizing Thevenin's theorem.



(a) 1A
(b) 2A
(c) 3A
(d) 4A

Q121. Proximity effect can be reduced by
(a) Reducing the voltage
(b) Reducing space between conductors
(c) Increasing the frequency
(d) Reducing size of the conductor

Q122. A generating station has a maximum demand of 5 MW and average load of 2800 kW then the load factorwill be
(a) 0.25
(b) 56
(c) 0.56
(d) 0.65

Q123. The Buchholz relay is used to protect the?
(a) Alternators against all internal faults.
(b) Oil immersed transformers against all internalfaults.
(c) Synchronous motors against all internal faults.
(d) Transmission lines against all short circuit faults.

Q124. If for a string insulator system, voltage across bottom last unit is 25% of total string voltage with 5 units; its string efficiency is?
(a) 80%
(b) 85%
(c) 90%
(d) 20%

Q125. The surge impedance of 400 km long overhead transmission line is 300 ohm. For a 200 km length of thesame transmission line surge impedance will be

(a) 150 ohm
(b) 600 ohm
(c) 75 ohm
(d) 300 ohm

Q126. The rated slip of an induction motor at full load is 5% while the ratio of starting current to full load current is four. The ratio of the starting torque to full load torque would be
(a) 0.6
(b) 0.8
(c) 1
(d) 1.4

Q127. What is the angle between stator direct axis and quadrature axis of a reluctance motor?
(a) 0°
(b) 90°
(c) 45°
(d) None of above

Q128. A universal motor is preferred for
(a) Low speed
(b) Low torque low speed
(c) High speed high torque
(d) None of above

Q129. A 220-V, 50-Hz, 6-pole, single-phase induction motor runs with 3% slip. Determine the rotor speed.
(a) 1455 rpm
(b) 728 rpm
(c) 970 rpm
(d) 960 rpm

Q130. When excitation of synchronous motor is increased up to normal excitation from under excitation, armature current
(a) Increases
(b) Decreases
(c) Remains constant
(d) None of above

Q131. Synchronous motor can be made self-starting by providing
(a) Damper winding on rotor poles
(b) Damper winding on stator
(c) Damper winding on stator as well as rotor poles
(d) None of above

Q132. A 12 Pole, 440V, 50Hz, 3-Phase 5 synchronous motor takes a line current of 100A at 0.8 pf leading Neglecting losses, the torque developed will be?
(a) 750 Nm
(b) 1165 Nm
(c) 1345 Nm
(d) 1236 Nm

Q133. Hunting occurs in….
(a) Synchronous motor
(b) Synchronous generator
(c) Transformer
(d) Both synchronous motor and synchronous generator

Q134. A synchronous motor runs at 600 rpm, Which of the following case is true
(a) P=10, f=50
(b) P= 12, f= 50
(c) P=6, f=50
(d) P= 10, f=60

Q135. When a 3-phase synchronous motor is switched ON, there exists a rotating magnetic field. The magnitude of this field flux
(a) Varies with load
(b) Varies with power factor
(c) Constant at all loads
(d) None of above

Q136. A three phase stack, variable reluctance stepper motor has 20 poles on each rotor and stator stack. The step angle of this stepper motor is
(a) 6 degree
(b) 9 degree
(c) 12 degree
(d) 18 degree

Q137. The range of efficiency of shaded pole motor is
(a) 90 to 100%
(b) 50 to 70%
(c) 80 to 90%
(d) 5 to 35%

Q138. The highest transmission voltage used in India is
(a) 400 kV
(b) 220 kV
(c) 132 kV
(d) 765 kV

Q139. In AC transmission system the load current is
(a) Independent of power factor
(b) Directly proportional to power factor
(c) Inversely proportional to power factor
(d) None of the above

Q140. Stringing chart represents a graph of _____.
(a) Sag and tension vs temperature
(b) Sag vs supply frequency
(c) Sag vs conductor size
(d) Tension vs sag

Q141. In a transmission system, the weight of copper used is proportional to
(a) E^2
(b) E
(c) $1/E^2$
(d) 1/E

Q142. Corona loss in DC transmission supply is _____.
(a) 10 times more than AC
(b) Infinite
(c) Zero
(d) Less than AC

Q143. Among the following statement which one is true?
(a) DC transmission is more efficient
(b) AC transmission is more efficient
(c) Both are efficient
(d) High voltage AC transmission is more efficient

Q144. Skin effects depends upon
(a) Supply frequency
(b) Cross-sectional area of the conductor
(c) Permeability of conductor material
(d) All of above

Q145. The inductance of transmission line increase with
(a) Increase in load current carried by the conductor
(b) Increase in spacing between phase conductors
(c) Decrease in line length
(d) None of these

Q146. In AC distribution system the voltage can be controlled by using
(a) Tap changing transformer
(b) Booster transformer
(c) Induction regulator
(d) Any of the above

Q147. Bus Bar is rated by
(a) Voltage only
(b) Current only
(c) Current ,voltage and frequency
(d) Current, voltage, frequency and short circuit current

Q148. The speed control of dc shunt motor in both directions can be obtained by
(a) Armature resistance control method
(b) Ward Leonard method
(c) Field diverter method
(d) Armature voltage control method

Q149. In a DC motor, speed control by varying the armature circuit resistance provides a
(a) Constant torque drive
(b) Variable torque drive
(c) Constant power drive
(d) Variable power drive

Q150. Which method is NOT used for controlling the speed of slip ring induction motor?
(a) Cascaded method
(b) Changing the pole method
(c) Slip power control method
(d) Rotor resistance method

Q151. Consider the following statements:
1. Surge impedance of a transmission line is independent of its length.
2. The size of conductor for modern EHV lines is determined on the basis of current density.
3. The insulation of EHV lines is designed on the basis of switching surges.
4. Synchronous compensation is being preferred over static compensation in EHV lines.
Which of the following statement is/are correct?
(a) 1 and 2 are correct
(b) 1 and 3 are correct
(c) 2 and 4 are correct
(d) 3 and 4 are correct

Q152. When the two windings of a transformer are connected electrically, it is called as:
(a) Auto transformer
(b) Two winding transformer
(c) Electrical transformer
(d) Ideal transformer

Q153. A short circuit current in an alternator is
(a) higher when fault occurs away from alternator
(b) higher when fault occurs near to alternator
(c) independent from the distance of fault occurs
(d) None

Q154. Find the emitter current of a transistor having a common base dc current gain of 0.92 and base current of 20μA?
(a) 0.15 mA
(b) 0.25 mA
(c) 0.35 mA
(d) 0.75 mA

Q155. _____ is a metal-semiconductor function diode without depletion layer.
(a) Zener diode
(b) Schottky diode
(c) Tunnel diode
(d) None of these

Q156. In DC machines, the main parts where core losses significantly occurs at:-
(a) the armature only
(b) both the armature and pole faces
(c) the yoke only
(d) the pole faces only

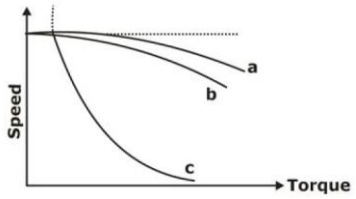
Q157. For a power system having induction motor loads, an overexcited synchronous motor is also attached.
The induction motor will now operate a
(a) lagging
(b) leading
(c) reduced power factor
(d) increased power factor

Q158. For a given three-phase induction motor, the slip at full load is
(a) equal to slip at no-load
(b) less than slip at no-load
(c) greater than slip at no-load
(d) equal to zero

Q159. The armature resistance of a DC motor is 0.4, the supply voltage is 200V and the back emf. is 198V at full speed. The armature current is?
(a) 4A
(b) 8A
(c) 5A
(d) 0.5A

Q160. 2's complement of 2's complement of the binary number 10010101 will be
(a) 01101010
(b) 01101011
(c) 10010100
(d) 10010101

Q161. Speed-torque characteristics of a dc series motor is shown by curve:



(a) a
(b) b
(c) c
(d) None of these

Q162. A 100 VA, 120/12 V transformer is to be connected so as to form a step–up transformer. A Primary voltage of 120 V is applied to the transformer. What is the secondary voltage of the transformer?
(a) 120V
(b) 12V
(c) 132V
(d) 220V

Q163. Wagner's earth devices are used in AC bridge Circuit for-
(a) Eliminating the effect of earth capacitances
(b) Eliminating the effect of inter component capacitances
(c) Shielding the bridge elements
(d) Eliminating the effect of stray electrostatic fields

Q164. A vector impedance meter measures
(a) The phase angle of the impedance
(b) The power dissipation in the impedance
(c) The magnitude of impedance
(d) Both the magnitude and phase angle of the impedance

Q165. Accuracy of an instrument means _____
(a) Repeatability of the measured value
(b) Closeness of the indicated by it to the correct value of measured
(c) Smallest change in the value of measured that can be detected by the instrument
(d) Speed with which the instruments reading approaches the final value

Q166. If an ammeter is to be used in place of a voltmeter, we must connect with the ammeter a
(a) low resistance in parallel
(b) low resistance in series
(c) high resistance in parallel
(d) high resistance in series.

Q167. While measuring power in a 3-ϕ load by two wattmeter method the readings of two wattmeter are equal & opposite when
(a) P.F is 0.6 leading
(b) PF is unity
(c) Load is balanced
(d) The load is pure inductive

Q168. A voltmeter must have very high internal resistance so that
(a) Accuracy is high
(b) Resolution is high
(c) Draws small amount of current
(d) Creates high loading effect of the circuit

Q169. An accurate ammeter must have a resistance of
(a) Very low value
(b) Low value
(c) High value
(d) None of the above

Q170. The range of a permanent magnet moving coil instrument used as an Ammeter can be increased by:
(a) connecting a high resistance in series with the instrument
(b) connecting a low resistance in series with the instrument
(c) connecting a low resistance in parallel with the instrument
(d) connecting a high resistance in parallel with the instrument

Q171. Copper shading is provided in energy meter to
(a) To increase speed of aluminium disc
(b) To balance the system from vibration
(c) Bring flux exactly in quadrature with applied voltage
(d) None of the above

Q172. The merging of a free electron and a hole is known as
(a) Recombination
(b) Extrusion
(c) Absorption
(d) Adsorption

Q173. An intrinsic semiconductor has equal number of electrons and holes in it. This is due to
(a) Free electrons
(b) Thermal energy
(c) Doping
(d) Valence electrons

Q174. Resistance of semiconductor by adding impurities
(a) Increase
(b) Decrease
(c) First increase, then decrease
(d) No change

Q175. The drift velocity of electron in silicon
(a) Is proportional to electric filed for all values of electric field.
(b) Is independent of electric field.
(c) Increases at lower values and decreases at higher values of electric field.
(d) Increases linearly with electric field at low values and gradually saturates at higher values of electric field.

Q176. The knee voltage of silicon and germanium PN junction is,
(a) 0.3 V, 0.7 V
(b) 0.5 V, 0.3 V
(c) 0.7 V, 0.3 V
(d) 0.5 V, 0.7 V

Q177. When signed numbers are used in binary arithmetic, then which one of the following notations would have unique representation for zero?
(a) Sign magnitude
(b) 1's complement
(c) 2's complement
(d) 9's complement

Q178. What is the decimal equivalent of hexadecimal number 8A7 ?
(a) 1422
(b) 1242
(c) 2114
(d) 2215

Q179. What is the effect of Negative Feedback on the Amplifier?
(a) There is a decrease in the gain of the Amplifier.
(b) There is an increase in frequency.
(c) There is a decrease in Bandwidth.
(d) There is an increase in phase distortion.

Q180. If applied voltage on a motor is 200 volts and back emf is 150 volts, the efficiency of the motor is-
(a) 100%
(b) 80%
(c) 50%
(d) 75%

Q181. A direct current motor bears internal resistance of 5 ohms. It is operated at 220 volts and draws 4 amp current. The power given to the motor (in watts) is-
(a) 880
(b) 1000
(c) 100
(d) 1100

Q182. Permanent magnet excitation is also known as:
(a) Shunt excitation
(b) Series excitation
(c) Separate excitation
(d) Compound excitation

Q183. In parallel operation, the DC generator normally preferred are
(a) Series
(b) Shunt
(c) Under compound
(d) Both shunt and under compound

Q184. In the case of parallel operation of DC compound wound generators for proper division of load from no load to full load it is essential that they should have the same
(a) Series field resistance
(b) Speed of operation
(c) Percentage regulation
(d) None of the above

Q185. A separately excited DC generator has included emf of 250 V and full load terminal voltage of 240 V. if the value of armature resistance is 0.2 Ω. Find the output of generator.

(a) 10 KW
(b) 12 KW
(c) 15 KW
(d) 18 KW

Q186. In a shunt generator the voltage build up is generally restricted by
(a) Saturation of iron
(b) Speed limitation
(c) Armature heating
(d) Insulation restriction

Q187. For a MOSFET, $V_{GS} = 3V$, I_{DSS} = 6A, and I_D = 3A. calculate the pinch off voltage V_P
(a) 6V
(b) 10.23 V
(c) 2 V
(d) 7.8 V

Q188. The transconductance g_m of an FET in the saturation region equals
(a) $\frac{-2I_{DSS}}{V_P}\left[1-\frac{V_{GS}}{V_p}\right]$
(b) $\frac{-2I_{DSS}}{V_p}\left(1-\frac{V_{GS}}{V_P}\right)^2$
(c) $\frac{-2I_{DSS}}{V_p}\left(1-\frac{V_{GS}}{V_P}\right)^{1/2}$
(d) None of the above

Q189. For transistor configured as a common emitter (CE) Amplifier, β = 40 and Amplifier Base current $(I_B) = 25\mu A$. What is the value of emitter current (I_E)?
(a) 10.25 mA
(b) 1.025 mA
(c) 102.5 mA
(d) 1025 mA

Q190. The method suitable for heating of conducting medium is____.
(a) Induction heating
(b) Indirect arc heating
(c) Eddy current heating
(d) Radiant heating

Q191. In an electrical heating process, the high frequency capacitive heating is also known as:
(a) Infrared heating
(b) Dielectric heating
(c) Induction heating
(d) Resistance heating

Q192. For arc heating, the electrodes used are made of
(a) Graphite
(b) Tungsten
(c) Copper
(d) Iron

Q193. The basic elements of an electric drive are
(a) Electric motor and the transmission system
(b) Electric motor, the transmission and control system
(c) The transmission and control system
(d) Electric motor and conversion equipment

Q194. The main drawback of electric drive is that
(a) It is cumbersome drive.
(b) It is costlier in initial as well as in maintenance cost.
(c) Electric power supply failure makes the drive standstill.
(d) None of the above

Q195. In which kind of wiring, single core or double or three core TRS cables with a circular oval shape cable is used?
(a) Cleat wiring
(b) Casing and capping wiring
(c) Batten wiring
(d) Conduit wiring

Q196. As per I.E., rule medium voltage line is
(a) 0 to 230 V
(b) 230 V to 650 V
(c) 650 V to 1000 V
(d) Above 1000 V

Q197. How many earth connections are required for the motor frame as per the IE role 61?
(a) One
(b) Two separate and distinct
(c) Three separate and distinct
(d) All of above

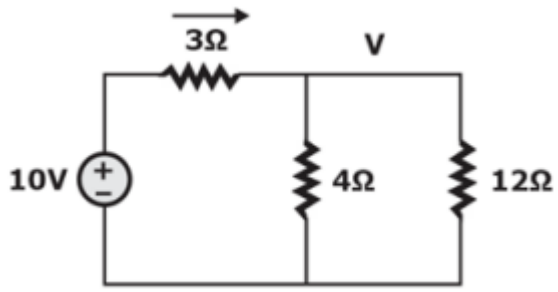
Q198. What is the dimension of the copper strips used for the strip earthing
(a) 25 mm × 4 mm
(b) 25 mm × 3 mm
(c) 25 mm × 2 mm
(d) 25 mm × 1 mm

Q199. To prevent the decaying owing to snow and rain, the wooden poles are protected by _____ cap at the top.
(a) Aluminium
(b) Zinc
(c) Cement
(d) All of above

Q200. The safety factor used for the current rating in a power installation is _____
(a) 0.5
(b) 1
(c) 1.5
(d) 2

SOLUTIONS

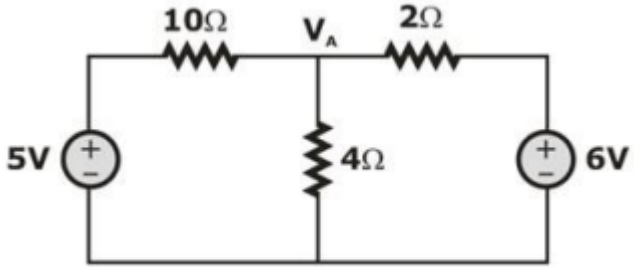
S101. Ans.(d)
Sol.



$\frac{V-10}{3}+\frac{V}{4}+\frac{V}{12}=0$
$4V-40+3V+V=0$
$V=5$ volt
The current in the resistor 3Ω is $\frac{10-5}{3}=\frac{5}{3}$
Power absorbed by 3Ω resistance $=I^2R=\left(\frac{5}{3}\right)^2\times 3=8.33$ W

S102. Ans.(c)
Sol. Delta or Mesh Connection System is also called Three Phase Three Wire System (3-Phase 3 Wire) and it is the best and suitable system for AC Power Transmission. A distribution transformer with a delta primary,
running on three 20kV phases with no neutral or earth required, and a star secondary providing a 3-phase supply at 400 V, with the domestic voltage of 230 available between each phase and an earthed neutral point.

S103. Ans.(b)
Sol.



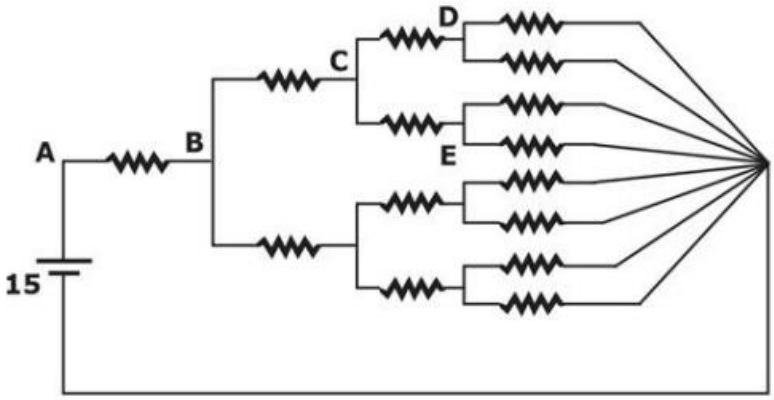
Applying KCL at node A

$\frac{V_A-5}{10}+\frac{V_A-0}{4}+\frac{V_A-6}{2}=0$

$V_A = 4.117V$

Current is 4Ω resistor $= \frac{V_A}{4} = 1.03$ A

S104. Ans.(a)
Sol.



$R_{DF} = R_{CF} = 2 \parallel 2 = 1\Omega$

$R_{CF} = (2+1) \parallel (2+1) = 1.5\Omega$

$R_{BF} = (1.5+2) \parallel (1.5+2) = 1.75$

$R_{AF} = 1.75 + 2 = 3.75$

$i = \frac{15}{3.75}$

$i = 4A$

S105. Ans.(d)
Sol.

Given, $v(t) = 50\sin(13t - 20)V$

at $t = 5$

$v(t) = 50\sin(13 \times 5 - 20)V$

$= 50\sin(65 - 20)V$

$= 50\sin 45°$

$= 35.35$ V

S106. Ans.(d)

Sol. In the circuit

L eq $= L_1 + L_2 + 2m$ ($M =$ mutual inductance)

$m = K\sqrt{L_1 L_2}$

$x_m = \omega m = K\sqrt{\omega L_1 \cdot \omega L_2}$

$= K\sqrt{9 \times 4} = 6K$

Also

$X_L = X_{L1} + X_{L2} + 2X_m = 9 + 4 + 12K$

$= 13 + 12K$

At series resonance

$X_C = X_L$

$30 = 13 + 12K$

$K = \frac{17}{12} = 1.416$

which is not possible because K is always less than 1. Hence resonance can't be achieved.

S107. Ans.(d)

Sol. A.C. ammeter reads rms value

$$I_{\text{rms}} = \sqrt{\frac{1}{\text{T}}\int_0^{\text{T}} \text{i}^2(\text{t})\text{dt}}$$

$$= \sqrt{\frac{1}{1}\int_0^1 (20\text{t})^2\text{dt}} = \sqrt{400\left[\frac{\text{t}^3}{3}\right]_0^1} = \frac{20}{\sqrt{3}} = 11.54 \text{ A}$$

S108. Ans.(c)

Sol. Tellegen's theorem is the only theorem that can be applied to any network, whether linear or non-linear, active or passive, time-variant or time-invariant. Tellegen's theorem states that the sum of instantaneous power consumed by various elements in various branches is zero for any network. This theorem is based on the principle of conservation of energy, which applies to all systems, whether they are linear or non-linear, time-variant or time-invariant.

On the other hand, the other theorems given in the options, namely Norton's theorem, Thevenin's theorem, and Superposition theorem, are applicable only to linear circuits consisting of resistors, voltage sources, and current sources.

S109. Ans.(d)

Sol. In a series RLC circuit, if $X_C > X_L$, then the Current will lead the supply voltage.

S110. Ans.(c)

Sol. Conductance (G) $= \frac{1}{Resistivity\ (\text{R})}$

$\downarrow$

Unit $= \frac{1}{\text{ohm}}$ (mho or siemen)

S111. Ans.(d)

The law that states that in any closed circuit the current is directly proportional to the voltage, provided the physical conditions of the circuit are kept constant is Ohm's law.

V α I = (physical conditions constant)

⇓

Ohm's law

S112. Ans.(b)

The potential inside a charged hollow sphere is constant and equal to the potential on the surface.

Inside a charge hollow sphere

E = 0

and Electric field (E) = $\frac{-dv}{dx}$ volt/meter

So, V = Constant. (i.e. same everywhere)

S113. Ans.(b)

Sol. Paramagnetic materials have permeability slightly more than unity and for diamagnetic materials it is less than 1.

S114. Ans.(a)

Sol. Magnetic lines of force are always closed. Magnetic field lines always form closed loops, starting from the north pole and ending at the south pole of a magnet or from the positive end to the negative end of a current-carrying conductor. This is because magnetic field lines are continuous and do not have any starting or ending points.

S115. Ans.(c)

Sol. for HWR: $I_{rms} = \frac{I_m}{2}$

$\Rightarrow 20 = \frac{I_m}{2}$

$\Rightarrow I_m = 40A$

For FWR: $I_{rms} = \frac{I_m}{\sqrt{2}} = \frac{40}{\sqrt{2}}A$

S116. Ans.(c)

Sol.

Energy = Power × time

$E = 2 \times 1000 \times 10 \times 60$

$E = 2 \times 1000 \times 10 \times 6$

$E = 12{,}00000\ J$

$E = 1200\ kJ$

Alternate information:

$1\ kWh = 3.6 \times 10^6$ Joules

$= 3.6$ Mega Joule

S117. Ans.(c)

Sol.

We know that $C = \frac{Q}{V}$

$$C = \frac{\epsilon_0 A}{d}$$

Where, A = the area of each plate

d = distance between the plate

$C \alpha A$

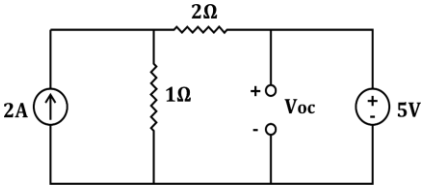
If area is four times the capacitance will be four times

S118. Ans.(b)

Sol. Field due to toroid having N turn and length ℓ carrying a filamentary current $I, H = \frac{NI}{\ell}$ (Turn-Amp/meter)

S120. Ans.(a)

Sol. Remove the 5Ω resistor from the circuit.

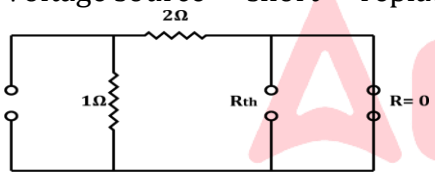


$V_{oc} = 5\ V$

For R_{th}

Current source → open

Voltage source → short → replacing by their internal impedances



$R_{th} = 0||3 = 0\Omega$

$\because I_{5\Omega} = \frac{V_{oc}}{R_{th}+R} = \frac{5}{0+5} = 1A$

$\because V_{th} = 5V$

$R_{th} = 0\Omega$

$I_{5\Omega} = 1A$

S121. Ans.(d)

Sol. It is possible to reduce the proximity effect by reducing the size of the conductor and the frequency and by increasing the voltage and space between conductors.

S122. Ans.(c)

Sol. Given: Maximum load = 5MW, Average load = 2800 kW

$$\text{Load factor} = \frac{\text{Average load}}{\text{Maximum demand}} = \frac{2800\times10^3}{5\times10^6} = 0.56$$

S123. Ans.(b)

Sol. The Buchholz relay is primarily used to protect oil-filled transformers against internal faults, such as faults involving the transformer's insulation or the presence of gases generated due to internal arcing or overheating. Therefore, Oil-immersed transformers against all internal faults is the correct answer.

S124. Ans.(a)

Sol. String efficiency, $\eta = \frac{V}{nV_s} \times 100\%$

$n = 5$

$V_S = 25\%$ of V

(Where V = total string voltage)

So, $\eta = \frac{V}{5 \times 0.25\ V} \times 100\%$

$= \frac{1}{5 \times 0.25} \times 100 = 80\%$

S125. Ans.(d)

Sol. Surge Impedance $(Z_o) = \sqrt{\frac{L}{c}}$

Z_0 is not function of length.

$\therefore Z_o$ will remain same.

S126. Ans.(b)

Sol.

Full load slip (S_f) = 5% = .05

$\frac{starting\ torque\ T_{st}}{Full-load\ torque} = \left(\frac{I_{SC}}{I_f}\right)^2 \times S_f$

$= (4)^2 \times 0.05 = 0.8$

S127. Ans.(b)

Sol. a reluctance motor, the angle between the stator direct axis and quadrature axis is typically 90°. This angle is often referred to as the torque angle or the electrical angle. The stator direct axis is aligned with the stator magnetic field, while the quadrature axis is perpendicular to it. This angular displacement is necessary for the generation of torque in the reluctance motor.

S128. Ans.(c)

Sol. universal motors are a type of electric motor that can operate on both AC (alternating current) and DC (direct current) power sources. They are known for their high speed and high torque characteristics, which make them suitable for applications requiring both high rotational speed and high torque output.

S129. Ans.(c)

Sol. Given,

f = 50 Hz

P = 6

S = 3% = 0.03 N_r (Rotor Speed) = ??

Synchronous speed (N_S) = $\frac{120f}{P}$

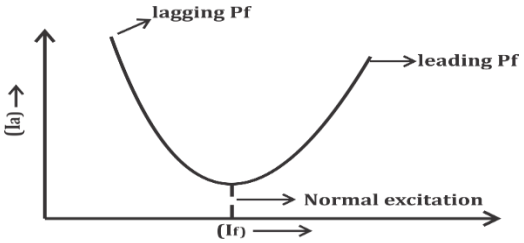
= $\frac{120 \times 50}{6}$ = 1000 rpm

Slip is given as, S = $\frac{N_S - N_r}{N_S}$

0.03 = $\frac{1000 - N_r}{1000} \Rightarrow$ N_r = 970 rpm

S130. Ans.(b)

Sol.



If we increase excitation and move towards normal excitation from under-excitation condition then Pf will increase and Armature current (I_a) will decreases.

S131. Ans.(a)

Sol. Synchronous motor is not self-starting. It can be made self-starting by providing "Damper winding on rotor pole faces and around the pole shoes.

Following is the primary function of damper winding: -

(i) Provides starting torque

(ii) Reduce hunting

(iii) Used for salient pole rotors

(iv) Under normal running condition, damper winding in synchronous machine does not carry and current because the relative velocity between the rotating magnetic field (RMF) of stator and the rotor is zero.

S132. Ans.(b)

Sol.

Power (P) = $\sqrt{3} \times V_L I_L COS \Phi$

= $\sqrt{3} \times 440 \times 100 \times 0.8$

= 60968.18W (approx. 60968)

We know that

Synchronous speed (N_s) = $\frac{120f}{P} = \frac{120 \times 50}{12} = 500\ rpm$

Torque developed T = $\frac{P}{\frac{2\pi Ns}{60}} = \frac{60968}{2\pi \times \frac{500}{60}} = 1164.4\ Nm$

S133. Ans.(d)

Sol. On the sudden application of load, the rotor searches for its new equilibrium position and starts oscillating. The phenomenon of oscillation of the rotor about its final equilibrium position is called **Hunting**.

• Hunting is a process occurs in a synchronous motor as well as in synchronous generators on an abrupt change in load.

S134. Ans.(a)

Sol.

$N_S = \frac{120f}{P}$ = 600rpm

If f f=50HZ then P= $\frac{120\times50}{600}$ = 10

If f f=60HZ then P= $\frac{120\times60}{600}$ = 12

S135. Ans.(c)

Sol. When a 3-phase synchronous motor is switched ON, there exists a rotating magnetic field. The magnitude of this field flux is constant at all loads.

S136. Ans.(a)

Sol.

Step Angle (α)= $\frac{360^\circ}{mN_r}$

m= 3 , N_r= 20

(α)= $\frac{360^\circ}{3\times20}$=*6 degree*

S137. Ans.(d)

Sol. A shaded pole motor is small squirrel cage motor in which the auxiliary winding is composed of copper ring or bar surrounding a portion of each pole

And their ranges of efficiency vary from 5 to 35%.

S138. Ans.(d)

Sol. In India, 765 kV is the maximum transmission voltage. Power Grid Corporation builds these lines for interstate communication throughout the entire nation.

S139. Ans.(c)

Sol. In AC transmission system the load current is inversely proportional to the power factor. The power factor is the cosine of the phase angle between the voltage and current waveforms. As the power factor decreases (becomes more lagging or leading), the load current increases, and vice versa.

P= $V_L I_L$Cos∅

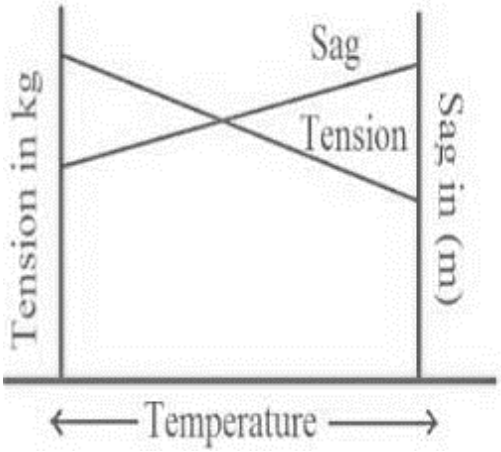
$I_L = \frac{\text{P}}{V_L.\text{Cos}\emptyset}$

$I_L \alpha \frac{1}{\text{Cos}\emptyset}$

S140. Ans.(a)

Sol. Stringing chart gives the data per sag to be allowed and the tension to be allowed in a transmission line for a particular temperature.

It represents a graph of sag and tension V/S temperature.



S141. Ans.(c)

Sol. In a transmission system, the weight of copper used is proportional to $1/E^2$. Thus greater is the transmission voltage level, lesser is the volume of copper required i.e. the weight of copper used for the conductors. The conductor material required is less, for higher transmission voltage.

S142. Ans.(d)

Sol. The corona loss in a transmission line is directly proportional to the operating frequency.

$P_c(\text{corona loss}) \propto (f + 25)$

for $f_{dc} = 0$ Hz and $f_{ac} = 50$ Hz

$\frac{P_{DC}}{P_{AC}} = \frac{0+25}{50+25}$

$P_{DC} = \frac{1}{3} P_{AC}$

Therefore, corona loss in DC transmission is less than AC.

S143. Ans.(a)

Sol. High voltage DC transmission is more efficient than AC transmission. HVDC (high voltage DC) transmission is provide great stability, reliability and transmission capacity. AC lines have more line losses than DC for bulk power transmission.

S144. Ans.(d)

Sol. The skin effect is a phenomenon that occurs in a conductor carrying AC that causes the current to be concentrates near the surface of the conductor, rather than being evenly distributed throughout its cross-section. This effects depends on several factors including.

(a) frequency

(b) permeability of conductor

(c) cross-sectional area of conductor

(d) temperature of the conductor

S145. Ans.(b)

Sol. Inductance of power transmission line increase with increase in spacing between phase conductor.

$L = \frac{\mu_0}{2\pi} \log\left(\frac{d}{r}\right)$

S146. Ans.(d)

Sol. In ac distribution system the voltage can be controlled by using

1. Induction regulator
2. Booster transformer
3. Tap changing transformer

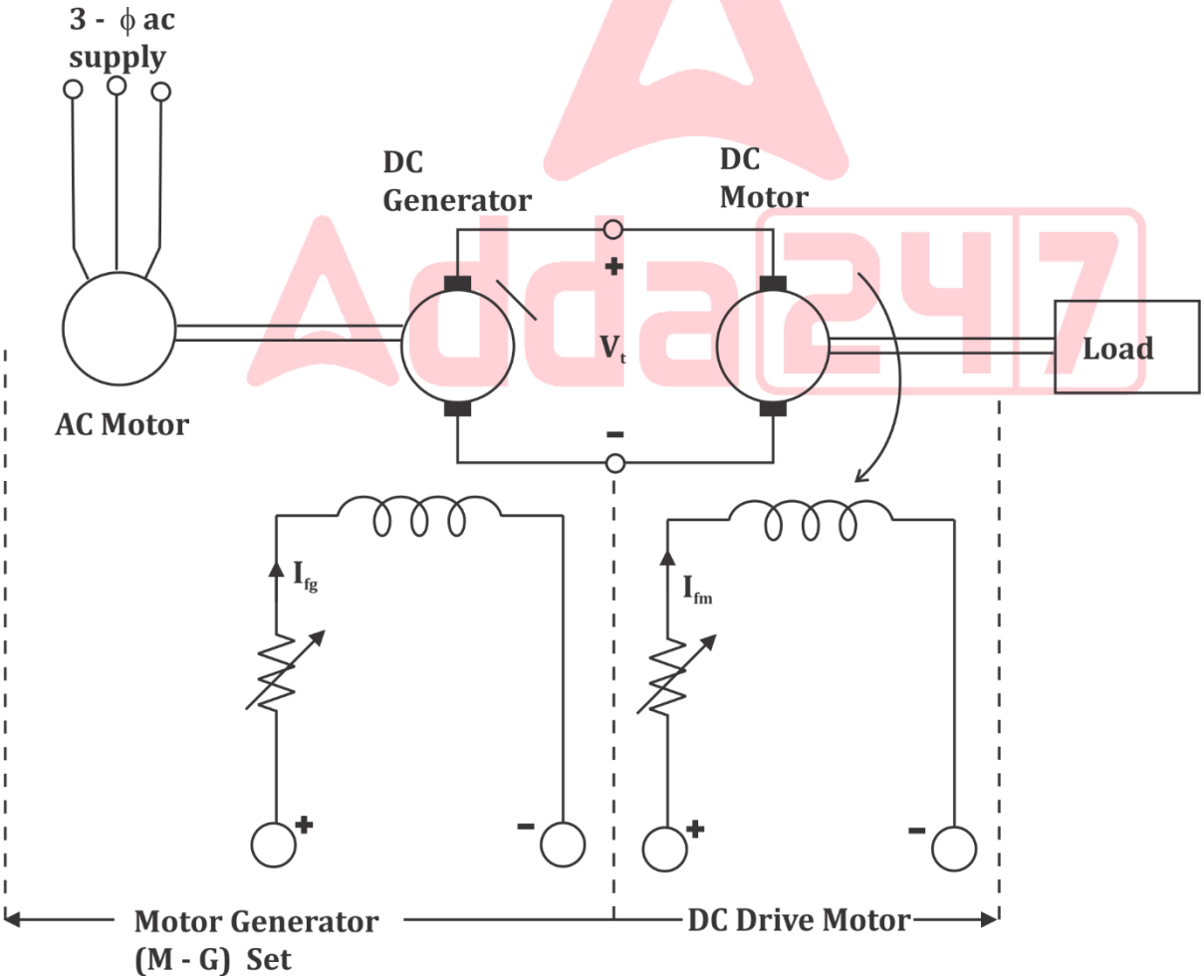
S147. Ans.(d)

Sol. The rating of a bus bar is determined by several factors, including current, voltage, frequency, and short- circuit current.

S148. Ans.(b)

Sol. The speed control of dc shunt motor in both directions can be obtained by Ward Leonard method. Speed control of dc motors can also be obtained by varying the applied voltage to the armature. Ward-Leonard System of speed control is based on this principle. This method was introduced in 1891. In this system M is the main dc motor whose speed is to be controlled, and G is a separately excited dc generator. The generator G is driven by a 3-phase driving motor which may be an induction motor or a synchronous motor. The combination of ac driving motor and the dc generator is called the motor-generator $(M-G)$ set.

DIAGRAM WARD- LEONARD:-



S149. Ans.(a)

Sol. Speed control by varying the resistance in the armature circuit varies the hardness of the speed–torque characteristics and therefore results in a different stability of operation for a given speed. This type of control is used to reduce the speed below the base speed at constant load torque.

S150. Ans.(b)

Sol. In slip ring induction motor rotor has winding on it. If no of the poles of the stator is changed then then we have to change design of rotor winding to make rotor poles equal to stator winding. Hence, Changing the pole method is not used for controlling the speed of the slip ring induction motor.

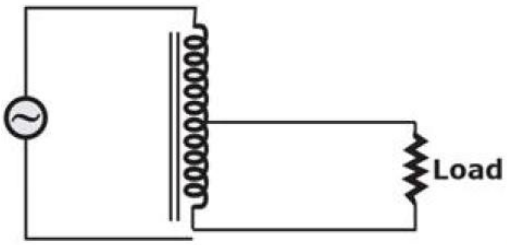
S151. Ans.(b)

Sol. Surge impedance of a transmission line is independent of its length.

- The insulation of EHV lines is designed on the basis of switching surges.

S152. Ans.(a)

Sol.



In an auto transformer, one single winding is used as primary winding as well as secondary winding. But in two windings transformer two different windings are used for primary and secondary purpose.

Advantage of autotransformer

- Its efficiency is more when compared with the conventional one.
- Its size is relatively very smaller.
- Voltage Regulation of auto transformer is much better.

S153. Ans.(b)

Sol. As short circuit current,

$I_{sc}\ \alpha\ \frac{1}{X_s}$

Where, X_s in inductance of line

When fault is near to alternator, inductance value will be smaller as it is proportional in length of line. Hence, short circuit current will be higher.

S154. Ans.(b)

Sol. Given, base current, I_b = 20 μA

Given, base current, $I_b = 20\mu A$

$\alpha = 0.92$

Collector current, $I_C = bl_b = \frac{\alpha}{1-\alpha} I_b$

$I_C = \frac{0.92}{1-0.92} \times 20\mu A$

$I_C = 230\mu A$

Emitter current, $I_E = I_C + I_b$

$I_E = 230 \times 10^{-6}A + 20 \times 10^{-6}A$

$I_E = 250 \times 10^{-6}A$

$I_E = 0.25mA$

S155. Ans.(b)

Sol. Schottky diode is a metal-semiconductor function diode without depletion layer.
In Schottky diode, no depletion layer is formed and there are no holes in this diode.

S156. Ans.(b)

Sol. Core losses occur mainly in armature because of the rotating part and the change in flux linkage at all instants. At pole shoe, same happens due to change in flux linkages.

S157. Ans.(a)

Sol. Adding synchronous motor will improve the pf of the system but then the induction motor will still work at lagging pf only.

S158. Ans.(c)

Sol. For a three-phase induction motor, the slip at full load is greater than slip at no-load.

S159. Ans.(c)

Sol. For DC motor, V = E + $I_a R_a$

V = 200 V

E = 198 V

R_a = 0.4 ohm

$I_a = \frac{200-198}{0.4}$ = 5A

S160. Ans.(d)

Sol. 2's complement of 2's complement of any number is same as the original one
2's complement of 10010101 = 01101011
2's complement of 01101001 = 10010101
So, Ans is 10010101.

S161. Ans.(c)

Sol. Torque of dc series motor , $T = k_a \phi_{se} l_a$

Now $= k_a k_{se} l_a{}^2$

Here $k_a k_{se} = k \rightarrow$ constant

$T = k l_a{}^2$

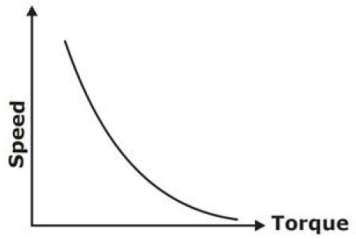
$I_a = \sqrt{\frac{T}{k}}$

Now, $E = V - I_a(R_a + R_{se}) = k_n \phi_{se} N$

$$\Rightarrow N = \frac{V}{k_n \phi_{se}} - \frac{I_n \cdot R_a}{k_n \phi_{se}} \; [R_a = r_a + r_{se}]$$

$$\Rightarrow N = \frac{V}{k_n k_{se}} - \frac{R_a}{k_n k_{se}}$$

There is inverse relation between torque and speed.



S162. Ans.(c)

Sol. For stepping up, the turn ratio is

$\frac{120+12}{120} = \frac{132}{120}$

$V_{\text{secondary}} =$ Turns ratio * V_{primary}

$V_{\text{secondary}} = \frac{132}{120} \times 120 = 132V$

S163. Ans. (a) The Wagner's earthing devices is used for removing the effect of earth capacitances from the bridges. It is a type of voltage divider circuit used to reduce the error which occurs because of stray capacitance. The Wagner's earth device provides high accuracy to the bridge

S164. Ans.(d)

Sol. A vector impedance meter measures both the magnitude and phase angle of the impedance.

→ this method determines Z in polar form, that is it gives the magnitude (Z) and the phase angle (O) of the impedance being tested.

S165. Ans.(b)

Sol. Accuracy means closeness of the indicated by it to the correct value of measured. Or it is the closeness with which an instrument reading approaches the true value of the quantity being measured i.e. conformity to truth.

S166. Ans.(d)

Sol. If an ammeter is to be used in place of a Voltmeter we must connected with ammeter a high resistance in series.

→ since resistance of voltmeter is very high and resistance of ammeter is less so when we replace voltmeter with ammeter we connect high resistance in series to protect ammeter.

S167. Ans.(d)

Sol.

$\phi = \tan^{-1}\left[\sqrt{3}\left(\frac{w_1 - w_2}{w_1 + w_2}\right)\right]$

$w_2 = -w_1$

$\phi = \tan^{-1}\left[\sqrt{3}\left(\frac{w_1 + w_1}{w_1 - w_1}\right)\right]$

$\phi = \tan^{-1}\left[\sqrt{3}\left(\frac{2w_1}{0}\right)\right]$

$\phi = \tan^{-1} \infty$

$\tan \phi = \tan 90°$

$\phi = 90°$

so the load is pure inductive.

S168. Ans.(c)

Sol. voltmeter having high internal resistance so it draws low current and correctly measure the potential difference connected across the point a-b.

S169. Ans.(a)

Sol. An ammeter is an instrument for measuring the electric current in amperes in a branch of an electric circuit. It must be placed in series with the measured branch, and must have very low resistance to avoid significant alteration of the current it is to measure.

S170. Ans.(c)

Sol. PMMC as an ammeter: -

By connecting low value of shunt resistance across instrument.

S171. Ans.(c)

Sol. Copper shading, also known as shading bands or shading rings, is provided in an energy meter to bring the flux exactly in quadrature with the applied voltage. The purpose of this is to improve the accuracy of the meter's measurements.

S172. Ans.(a)

Sol.

- When semiconductor receiver external energy, valence band electrons are lifted to conduction band, leaving holes in valence band.
- The orbits of free electrons in conduction band are bigger than the orbits of holes in valence band.
- one atom's conduction band intersects the enter orbit of another and electron from C.B. falls into a hole as a result of they
- They merge of electron & hole call a Recombination

S173. Ans.(b)

Sol. An intrinsic semiconductor has equal number of electrons and holes in it. This is due to thermal energy. In an intrinsic semiconductor at thermal equilibrium, some electrons from the valence band are thermally excited to the conduction band, creating equal numbers of electrons and holes. This balance is achieved through the energy provided by thermal agitation. It does not depend on factors like free electrons, doping, or the specific characteristics of valence electrons.

S174. Ans.(b)

Sol. by adding impurities Resistance of semiconductor is decrease. Impurities such as Arsenic, Antimony, Phosphorous are added in N-type semiconductors. Impurities such as Aluminium, Gallium and Indium are added in P-type semiconductors.

S175. Ans.(d)

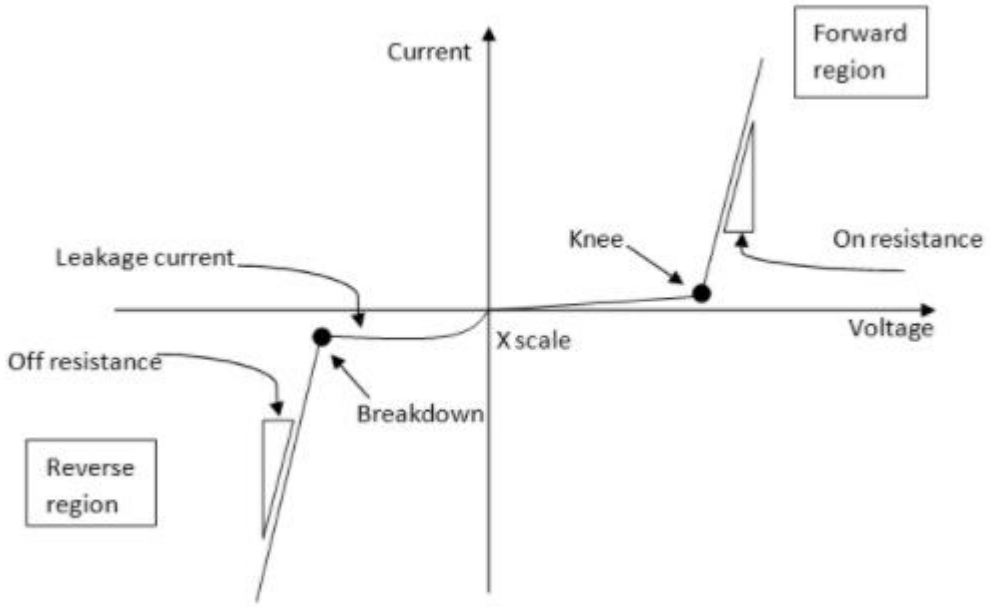
Sol. In silicon, the drift velocity of electrons initially increases linearly with the electric field at lower values of the field strength. However, as the electric field strength increases, the drift velocity begins to saturate and doesn't increase linearly anymore.

S176. Ans.(c)

Sol. The knee voltage, also known as the cut-in voltage or threshold voltage, represents the point at which a PN junction starts conducting significantly.

Silicon PN Junction: The knee voltage for silicon is around 0.7 V. This means that before the voltage reaches approximately 0.7 V in the forward bias direction, there's minimal conduction. However, once the applied forward voltage exceeds this value, the current through the silicon PN junction increases significantly.

Germanium PN Junction: The knee voltage for germanium is around 0.3 V. Germanium has a lower threshold voltage compared to silicon. Similar to silicon, minimal conduction occurs before the voltage reaches approximately 0.3 V in the forward bias direction, and significant conduction occurs after surpassing this voltage.



S177. Ans.(c)

Sol. In binary arithmetic, when signed numbers are used, the 2's complement notation has a unique representation for zero. The 2's complement representation is commonly used because it has the advantage of having a unique representation for zero and simplifies arithmetic operations like addition and subtraction.

S178. Ans.(d)

Sol. To convert a hexadecimal number to its decimal equivalent,

8A7 (hexadecimal) = $(8 \times 16^2) + (A \times 16^1) + (7 \times 16^0)$

Now, in hexadecimal, A represents the decimal value 10.

$(8A6)_{16} = (8 \times 256) + (10 \times 16) + (7 \times 1)$

$(8A6)_{16} = 2048 + 160 + 7$

$(8A6)_{16} = (2215)_{10}$

So, the decimal equivalent of the hexadecimal number 8A6 is 2215.

S179. Ans.(a)

Sol. We know that,

$$A_f = \frac{A}{1+A\beta}$$

Negative feedback reduces gain.

S180. Ans.(d)

Sol. Given, V = 200 V,

$E_b = 150$ V

Power output = back emf × current

$$\eta\% = \frac{\text{power output } (E_b I_a)}{\text{Power input } (V_a)} = \frac{150}{200} \times 100 = 75\%$$

S181. Ans.(a)

Sol.

Given that,

$I_a = 4A$

$R_a = 5\Omega$

$V = 220$ Volts

$\therefore V = E + I_a R_a$

Back emf $(E) = V - I_a R_a$

$E = 220 - 4 \times 5 = 200$ V

Input power to motor $= E_a I_a + I_a^2 R_a$

$= 200 \times 4 + 4^2 \times 5 = 880$ W

S182. Ans.(c)

Sol. Permanent magnet excitation is also known as Separate excitation. In separate excitation, a separate source of excitation, such as a permanent magnet, is used to create the magnetic field in a DC machine or motor, independent of the armature current. This allows for control of the field strength and, consequently, the motor's performance.

S183. Ans.(d)

Sol. DC shunt & under compound DC generators due to their drooping characteristics are to best suited for parallel operation.

S184. Ans.(c)

Sol. For satisfactory operation, it is durable that all the machines operating in parallel should have same percentage voltage regulation so as to share the total load in proportion to their rated capacity.

S185. Ans.(b)

Sol.

$E_g = 250\ V \qquad V_t = 240\ V$

$R_a = 0.2\ \Omega$

$E_g = V_t + I_aR_a$

$250 = 240 + I_a \times 0.2$

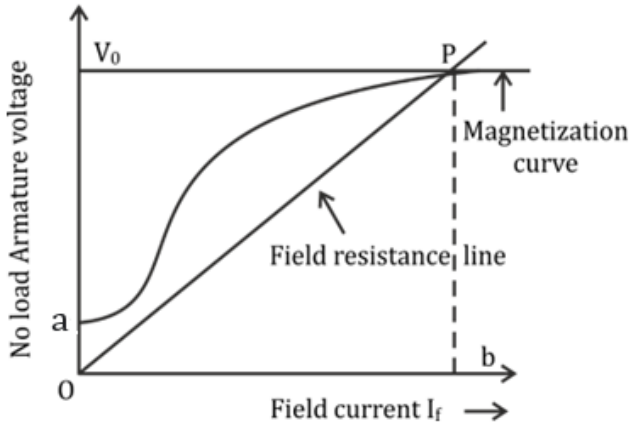
$I_a = \frac{250 - 240}{0.2} = 50\ Amp$

$Output = V_tI_a$

$= 240 \times 50 = 12000\ W = 12\ KW$

S186. Ans.(a)

Sol. In a shunt generator the voltage build up is generally restricted by saturation of iron. Once the terminal voltage is reached then the winding will get saturated and hence there won't be any further increase in flux, also the voltage gets constant.



S187. Ans.(b)

Sol. $V_{GS} = 3V, I_{DSS} = 6A \ and \ I_D = 3A$

$I_D = I_{DS}\left(1 - \frac{V_{GS}}{V_P}\right)^2$

$3 = 6\left(1 - \frac{3}{V_P}\right)^2$

$\frac{3}{6} = \left(1 - \frac{3}{V_p}\right)^2$

$\frac{1}{\sqrt{2}} = 1 - \frac{3}{V_P}$

$1 - \frac{1}{\sqrt{2}} = \frac{3}{V_P}$

$\boxed{V_P = 10.23V}$

S188. Ans.(a)

Sol. Drain to source current is

- $I_{DS} = I_{DSS}\left(1 - \frac{V_{GS}}{V_P}\right)^2$

Transconductance is

- $g_m = \frac{\partial I_D}{\partial V_{GS}}$

$g_m = \frac{-2I_{DSS}}{V_P}\left(1 - \frac{V_{GS}}{V_P}\right)$

S189. Ans.(b)

Sol. Current gain (β) = 40

Base current $(I_B) = 25\ \mu A = 25 \times 10^{-6} A = 0.025\ mA$

Emitter current $(I_E) = ?$

$\beta = \frac{I_C}{I_B}$

$I_C = \beta I_B = 40 \times 25 \times 10^{-6}$

$I_C = 10^{-3} A = 1\ mA$

$I_E = I_C + I_B$

$I_E = 1mA + 0.025\ mA \Rightarrow 1.025\ mA$

S190. Ans.(a)

Sol. Induction heating is the process of heating an electrically conducting object by electromagnetic induction, through heat generated in the object by eddy currents. This is the most suitable for heating of conducting medium, usually at frequencies between 100 and 500 kHz.

S191. Ans.(b)

Sol. The process of heating in which a high-frequency alternating electric field or radio waves or microwave electromagnetic radiation are used to heat the dielectric materials is known as dielectric heating.

Dielectric heating is also known as high frequency capacitive heating.

S192. Ans.(a)

Sol. graphite is the most commonly used material for arc electrodes due to its high melting point, low reactivity, and ability to conduct electricity. Graphite electrodes are widely used in applications such as steelmaking, metalworking, and glass manufacturing.

Arc heating is a process that involves the use of an electric arc to heat or melt a material. The electric arc is generated between two electrodes, which are typically made of materials that can withstand high temperatures and resist melting or vaporization.

S193. Ans.(b)

Sol. The basic elements of an electric drive are Electric motor, the transmission, and control system.

S194. Ans.(c)
Sol. The main drawback of electric drive is that Electric power supply failure makes the drive standstill.
It has a poor dynamic response
It cannot install where electricity is not available.

S195. Ans.(c)
Sol. Batten wiring is basically an internal wiring system and are of two types:
- CTS or TRS or PVC sheath wiring
- Lead sheathed or metal sheathed wiring

CTS cables are available in single-core, twin-core or three core with a circular or oval in shape.

S196. Ans.(b)
Sol. As per IE rules,1956:
- Low voltage: < 230 V
- Medium voltage: 230 V to 650 V
- High voltage: <33 KV
- Extra high voltage: > 33 KV

S197. Ans.(b)
Sol. As per the IE Rule 61 (Indian Electricity Rules, 1956), a motor frame requires two separate and distinct earth connections.

S198. Ans.(a)
Sol. Copper is used then the dimension will be cross-section of 25 mm × 4 mm

S199. Ans.(d)
Sol. Wooden poles used in power distribution systems are often protected from decay caused by snow and rain by using various methods. One common method is to install a cap at the top of the pole. These caps can be made of different materials such as aluminium, zinc, or even cement. The purpose of the cap is to provide a protective barrier against moisture, preventing it from seeping into the wood and causing decay. Therefore, all the options mentioned (aluminium, zinc, and cement) can be used as protective caps for wooden poles.

S200. Ans.(d)
Sol. The safety factor used for the current rating in a power installation is 2.