RBI JE Electrical Sample paper

Q1. When a single turn coil rotates in a uniform magnetic field, at uniform speed, the induced emf will be?
(a) Alternating
(b) Steady
(c) Pulsating
(d) None of these.

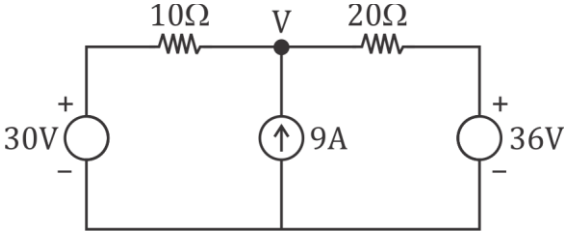
Q2. In a transformer zero voltage regulation at full load can happen –
(a) At leading power factor load
(b) At lagging power factor load
(c) At unity power factor load
(d) Can not happen at all

Q3. The size of a synchronous motor decreases with the increase in
(a) Horse power rating
(b) Speed
(c) Flux density
(d) All of the above

Q4. For a linear electromagnetic circuit, which of the following statement is true?
(a) Field energy is equal to the co-energy
(b) Field energy is greater than the co-energy
(c) Field energy is lesser than co – energy.
(d) Co- energy is zero.

Q5. The making to breaking current ratio for an EHV circuit breaker is –
(a) More than 1
(b) Less than 1
(c) Equal to 1
(d) A negative Number.

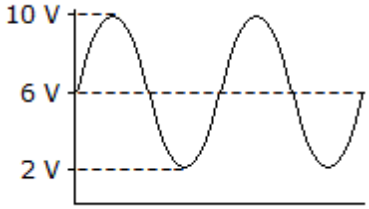
Q6. The node voltage V in the circuit is-



(a) 30 V
(b) 6 V
(c) 92 V
(d) 36 V

Q7. What happens to MMF when the magnetic flux increase?
(a) Increases
(b) Decreases
(c) Becomes zero
(d) Remains constant

Q8. What is the peak-to-peak voltage of the waveform in the given circuit?



(a) 2 V
(b) 4 V
(c) 6 V
(d) 8 V

Q9. The fault occurring In Transmission is _____
(a) L – G
(b) L – L
(c) L – L – L
(d) L – L – G

Q10. In a 4-pole 20 kW, 200 V wave wound DC Shunt Generator, the current in each parallel path will be
(a) 50
(b) 60
(c) 70
(d) 40

Q11. The inductance of a high Q inductor can be measured using a
(a) Schering bridge
(b) Wein bridge
(c) Maxwell bridge
(d) Hay's bridge

Q12. At f = _____ ; R – L – C series circuit operates at unity power factor.
(a) 1/RLC
(b) 1/LC
(c) 1/RC
(d) $\frac{1}{2\pi\sqrt{LC}}$

Q13. Arc in a circuit breaker is interrupted at à
(a) Zero current
(b) Maximum current
(c) Minimum voltage
(d) Maximum voltage

Q14. Which effect is the converse of Peltier effect?
(a) Thomson effect
(b) Seebeck effect
(c) Hall effect
(d) Joule effect

Q15. Which of the following option are advantage of high power factor
(a) Increase efficiency
(b) Improved voltage regulation
(c) Increased capacity/improved system performance
(d) All of these

Q16. The reactive power transfer over a line mainly depends on
(a) V_R
(b) $|V_S| - |V_R|$
(c) V_S
(d) Power Angle S

Q17. Maximum efficiency of a transformer occurs when
(a) Net core loss is equal to copper loss
(b) Power factor is leading
(c) Hysteresis loss equals to eddy current loss
(d) Core losses are minimum

Q18. The voltage that appears across the contacts after the circuit breaker is opened is called.
(a) Restriking voltage
(b) Arc voltage
(c) Recovery voltage
(d) Surge voltage

Q19. The best location for use of a booster transformer in a transmission line is
(a) At the sending end
(b) At the receiving end
(c) At the intermediate point
(d) Any where in the line

Q20. A single phase transmission line of impedance $j0.16\ \Omega$ supplies a resistive lead of 800 A at 500 V the sending and power factor is
(a) 0.6 lagging
(b) 0.7 lagging
(c) 0.97 lagging
(d) 0.85 lagging

Q21. The Energy efficiency (All day efficiency) of a transformer is define as the ratio of
(a) kWh output over 24 hour to the kWh input over 24 hour
(b) kW output over 24 hour to the kW input over 12 hour
(c) KVA output over 24 hour to the KVA input over 12 hour
(d) None of above

Q22. A guard ring is provided in a megger to
(a) Reduce current flow
(b) Protect the circuit
(c) Eliminate error
(d) Increase voltage

Q23. Current passing through a inductor is 4 Amp. Energy stored in the inductor of inductance is 0.2 Henry will be
(a) 1.2 J
(b) 0.16 J
(c) 0.8 J
(d) 1.6 J

Q24. A BJT is Biased with a power supply of 10V. for minimum heat dissipation, the drop across the transistor will be?
(a) 5 V
(b) 9 V
(c) 10 V
(d) 12 V

Q25. Commonly used dielectric in electrolytic capacitor is _____
(a) Mgo
(b) MnO_2
(c) Al_2O_3
(d) Cd_3N_2

Q26. Voltage regulation of a transmission line should be _____
(a) Minimum
(b) Maximum
(c) Greater than 50 %
(d) Less than 50 %

Q27. A thyristor equivalent of a thyratron tube is
(a) UJT
(b) DIAC
(c) SCR
(d) TRIAC

Q28. What happens if the field winding of the synchronous motor is short-circuited?
(a) First, starts as induction motor then run as synchronous motor
(b) Not start
(c) Motor will burn out
(d) Run as induction motor

Q29. In an electric heater, the metal case is connected to
(a) Phase wire
(b) Earth wire
(c) Neutral Wire
(d) None of these

Q30. The insulating material for a cable should have
(a) Low cost
(b) High dielectric strength
(c) High mechanical strength
(d) All of the above

Q31. Which of the following load normally need starting torque more than the rated torque?
(a) Conveyors
(b) Blowers
(c) Centrifugal pump
(d) Air compressor

Q32. The application of Differentially compound motor is
(a) Frequent on-off cycle
(b) Low starting torque
(c) High starting torque
(d) Variable speed

Q33. What type of earthing is found in the 11 kV sub-station?
(a) Plate earthing
(b) Rod earthing
(c) Strip earthing
(d) Pipe earthing

Q34. The electrostatic stress in underground cables is
(a) Same at the conductor and the sheath
(b) Minimum at the conductor and maximum at the sheath
(c) Zero at the conductor as well as on the sheath
(d) Maximum at the conductor and minimum at the sheath

Q35. Shunt generators are most suited for stable parallel operation as their voltage characteristics are
(a) Drooping
(b) Rising
(c) Linear
(d) Identical

Q36. If the distance between the light source and the surface is reduced to half, the illumination on the surface will
(a) Reduce to half of the original.
(b) Reduce to one fourth of the original.
(c) Increase to double of the original.
(d) Increase to four times of the original.

Q37. In dynamometer wattmeter the compensation coil
(a) Has equal number of turns of voltage coil and is connected in series with current coil
(b) Has equal number of turns of current coil and is connected in series with voltage coil
(c) Has equal number of turns of current coil and is connected in series with current coil
(d) Has equal number of turns of voltage coil and is connected in series with voltage coil

Q38. Condition of symmetry in Z-parameter representation is
(a) $Z_{11} = Z_{12}$
(b) $Z_{11} = Z_{22}$
(c) $Z_{12} = Z_{21}$
(d) $Z_{12} = Z_{22}$

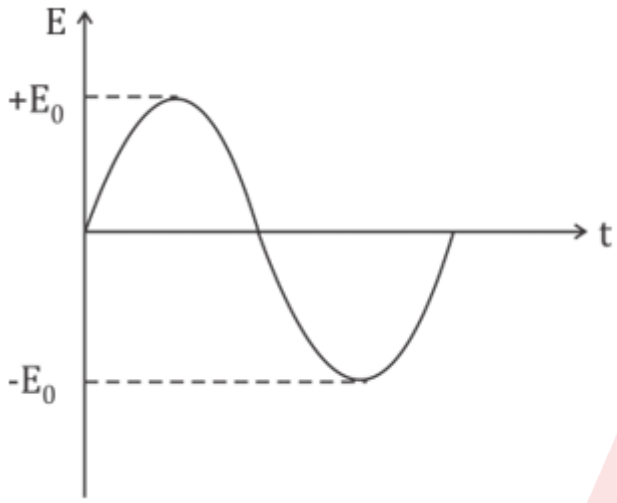
Q49. The two-wattmeter method is used to measure the power of a three-phase balanced system powered by a 415 V, three-phase, 50 Hz power supply. If the reading on each wattmeter is 10.5 kW, calculate the power factor.
(a) 1
(b) 0.98 Lagging
(c) 0.88 lagging
(d) 0.858 lagging

Q40. High speed alternators driven by …….
(a) Diesel engines
(b) Water turbines
(c) Steam turbines
(d) None of above

SOLUTIONS

S1. Ans.(a)

Sol. When a single turn coil rotates in a uniform magnetic field, at uniform speed, the induced emf varies as sinωt and therefore called sinusoidally alternating emf. In one rotation of the coil sinωt varies between +ve and -ve and hence the induced emf varies between $+E_0$ and $-E_0$.



S2. Ans.(a)

Sol. Voltage regulation of a transformer is defined as % R = $\frac{E_2 - V_2}{V_2} \times 100$

% R = $\frac{IR\cos\phi \pm I \times \sin\phi}{V_2} \times 100$

+ve sign → lagging p.f.

–ve sign → leading p.f.

For zero voltage regulation, $E_2 = V_2$

⇒ I R cos ϕ = I × sin ϕ ('–' sign represents leading power factor)

$\phi = \tan^{-1}\left(\frac{R}{X}\right)$

$\cos\phi = \cos\tan^{-1}\left(\frac{R}{X}\right)$

This is the leading power factor at which voltage regulation becomes zero while supplying the load.

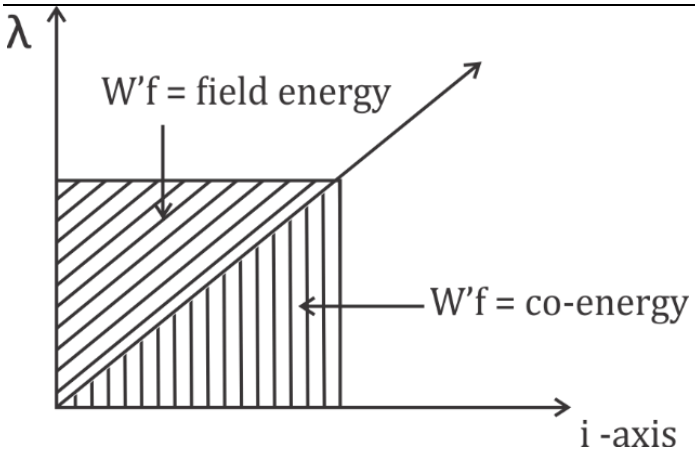
S3. Ans.(c)

Sol. $A\ \alpha\ \frac{1}{B_m}$

So, the size of a synchronous motor decreases with the increase in flux density.

S4. Ans.(a)

Sol. for a linear electromagnetic circuit, field energy is equal to the co-energy. The concept of co-energy and field energy shown below in diagram as the vibration of the flux linkage with the current



$\boxed{w_f = \int_o^i \lambda \, d_i}$

S5. Ans.(a) More than A.

Sol. Making capacity = 2.55 × Breaking capacity

or,

$\left(\frac{Making\ current}{Breaking\ current}\right)$ = 2.5 > 1.

S6. Ans.(c)

Sol. Apply KCL

$\frac{V-30}{10} + \frac{V-36}{20} = 9$

$V = 92\ V$

S7. Ans.(a)

Sol. Ohm's law for magnetic circuit states that the MMF is directly proportional to the magnetic flux hence as the magnetic flux increase, the MMF will increase.

$MMF = NI$

$\phi = \frac{NI}{R}$

$\phi\ \alpha\ MMF$

S8. Ans.(d)

Sol. peak-to-peak voltage is just the full vertical length of a voltage waveform from the very top to the very bottom.

$\therefore V_{P-P} = 10 - 2 = 8\ V$

S9. Ans.(a)

Sol. L – G (line to ground fault) are one of the most common type of fault that occur in transmission system. This type of fault occurs when one of the conductors in a transmission line comes into contact with the ground or any other grounded object, creating a short circuit.

S10. Ans.(a)

Sol.

$$P = V.I$$

$$20 \times 10^3 = 200 \times I$$

$$I = \frac{20 \times 10^3}{200}$$

$$I = 100\ Amp$$

for wave winding current in each parallel path $= \frac{I}{2}$

so current is $= \frac{100}{2} = 50\ Amp$

S11. Ans.(d)

Sol. The **Hay's bridge** is used for **determining** the **self-inductance** of the **circuit**. The bridge is the **advanced form** of **Maxwell's bridge**. The Maxwell's bridge is only appropriate for measuring the medium quality factor. Hence, for **measuring** the **high-quality factor** the **Hays bridge** is used in the circuit.

S12. Ans.(d)

Sol. For RLC series circuit at unity power factor, angle between voltage and current is zero and for this, the circuit should behave as pure resistive circuit.

- At resonance in the series RLC circuit, the voltage across inductor and capacitor is equal in magnitude and opposite in direction and thereby they cancel each other.
- In series, resonant circuit voltage across the resistor is equal to supply voltage at resonance condition.
- At resonance, both inductive and capacitive reactance cannel each other.
- So, total impedance of circuit is resistive only and circuit will acts as pure resistive circuit.

∴ Resonant frequency of RLC series circuit,

$$F_r = \frac{1}{2\pi\sqrt{LC}}$$

S13. Ans.(a)

Sol. Arc in a CB is interrupted at a zero current.

S14. Ans.(b)

Sol. Seebeck effect is converse of Peltier effect.

S15. Ans.(d)

Sol. A high power factor system is more efficient, reliable and cost effective than a low power factor system.

A high power factor means that more active power can be delivered with the same amount of apparent power. This allows the system to handle more loads and reduces the risk of overloading, leading to improve system performance and reliability.

S16. Ans.(b)

Sol. The reactive Power delivered by the line for a fixed sending end and receiving end voltage $|V_s|$ and $|V_R|$ is given by

$$Q_R = \frac{|V_R|}{X}\,[|V_S| - |V_R|]$$

$$Q_R\ \alpha\ [|V_S| - |V_R|]$$

S17. Ans.(a)

Sol. Maximum efficiency in a transformer occurs when copper loss equal to the iron loss.

Efficiency is maximum at fraction x of full load.

$$\chi = \sqrt{\frac{w_i}{w_{cu}}}$$

Where w_i =iron loss

$w_{cu} = copper\ loss$

∴kVA at maximum efficiency=Full load × $\sqrt{\frac{W_i}{W_{cu}}}$

$$\boxed{\%\eta = \frac{output}{output + P_i + P_i}}$$

i.e. Net core loss = Copper loss.

S18. Ans.(c)

Sol. The rms voltage that appears across the circuit breaker contacts after final arc interruption (or when breaker opens) is called "recovery voltage".

S19. Ans.(c)

Sol. A booster transformer is typically located at an intermediate point in a transmission line where the voltage needs to be increased or decreased.

The location of the booster transformer depends on several factors, including the length of transmission line, the voltage level of power being transmitted. And the load on the line. In general, booster transformer is located in areas where the voltage drop is significant due to long distance or high loads.

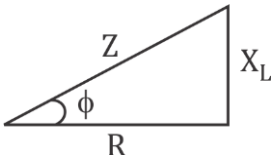
S20. Ans.(c)

Sol. Impedance $Z = j0.16\ \Omega$

Resistive load $= 800\ A, 500\ V$

$$R = \frac{500}{800} = .625\ \Omega$$

$$R = .625\ \Omega$$



$Z = R + jX_L$

$Z = .625 + j0.16$

$|Z| = \sqrt{(.625)^2 + (.16)^2}$

$|Z| = .644$

Power factor $(\cos\phi) = \frac{R}{Z} = \frac{.625}{.644} = .97$ lagging

S21. Ans.(a)

Sol. The energy efficiency of a transformer is typically measured by comparing the output energy to the input energy over a specific period of time. In this case, we are considering a 24-hour period.
The Energy efficiency (All day efficiency) of a transformer is define as the ratio of kWh output over 24 hour to the kWh input over 24 hour.

S22. Ans. (c)

Sol. the role of guard ring in a megger is to reduce the errors due to leakage current during insulation resistance measurement. guard ring is a conducting ring or electrode that surrounds the test electrode or terminal. megger works on the principle of electromagnetic Induction.

S23. Ans.(d)

Sol.

L = 0.2 H

I = 4 Amp

Energy stored in inductor = $\frac{1}{2}LI^2$

$= \frac{1}{2} \times 0.2 \times (4)^2$

$= \frac{1}{2} \times 0.2 \times 16$

E = 1.6 J

S24. Ans.(a)

Sol. for minimum heat dissipation the drop across the transistor will be = $\frac{1}{2}V_{cc} = \frac{1}{2} \times 10 = 5$ V

S25. Ans.(c)

Sol.

Commonly used material for electrolytic capacitor as dielectrics are aluminum oxide (Al_2O_3), Mica, Porcelain, Mylar ($C_{10}H_8O_4$) etc.

S26. Ans.(a)

Sol. More value of voltage regulation means more voltage fluctuations and this is undesirable. So, the value of voltage regulation should be as low as possible.

S27. Ans.(c)

Sol. A thyristor equivalent of a thyratron tube is SCR.

Thyristor is called SCR because it is silicon device and is used as a rectifier and that rectification can be controlled. The device is made of silicon only because leakage current in silicon is much smaller than that in Ge.

S28. Ans.(d)

Sol. If we short circuit the field winding of a synchronous motor then it will behave as an induction motor.

S29. Ans.(b)

Sol. To avoid the risk of electric shocks, the metal body of an electrical appliance is "earthed".

S30. Ans.(d)

Sol. The insulating materials used in cables should have the following properties

- High insulation resistance to avoid leakage current.
- High dielectric strength to avoid electrical breakdown of the cable.
- High mechanical strength to withstand the mechanical handling of cables.
- Non-hygroscopic, that is, it should not absorb moisture from air or soil.
- Noninflammable.
- Low cost so as to make the underground system a viable proposition.
- Unaffected by acids and alkalis to avoid any chemical action.

S31. Ans.(a)

Sol. Conveyors require high starting torque because the material is placed before the starting of the Conveyors belt. Therefore, conveyor required high starting torque and constant speed.

S32. Ans.(b)

Sol. In the differential compound, motor two field windings i.e., shunt and series windings oppose each other. This causes a reduction in flux and consequences a decrease in torque.

S33. Ans.(c)

Sol. strip earthing is used for 11 kV substation.

S34. Ans.(d)

Sol. The maximum potential gradient occurs at the surface of the conductor and the minimum at the sheath.

$G = \frac{V}{r \ln R/r}$

S35. Ans.(a)

Sol. Because of their slightly drooping voltage characteristics, Shunt generators are most suited for stable parallel operation.

S36. Ans.(d)

Sol. illumination (E) $= \frac{\text{Intensity (I)}}{(\text{Distance})^2}$

$\boxed{E = \frac{I}{r^2}}$

If the distance between the light source and the surface is reduced to half ie $r^1 = \frac{r}{2}$

then $E^1 = \frac{I}{\left(\frac{r}{2}\right)^2}$

$= {}^{4}\left(\frac{I}{r^2}\right)$

= 4E

S37. Ans.(b)

Sol. the high value current causes the error in the wattmeter. For reducing the error, the compensating coil is used. It reduces the error due to low Pf.

Compensating coil is in series with potential coil (PC).

in dynamometer wattmeter, the pressure **coil** is designed for having a low value of resistance so that the high value of current passes through it. **Compensating coil** has an equal number of turns of the current **coil** and is connected in series with a voltage **coil** or pressure **coil**.

S38. Ans.(b)

Sol. A two-port network is said to be symmetrical if the ports of the two-port network can be interchanged without changing the port voltages and currents. This will hold good, if $Z_{11} = Z_{22}$.

S39. Ans.(a)

Sol. The power factor of the two wattmeter is

$tan\,\Phi = \sqrt{3}\frac{(W1 - W2)}{(W1 + W2)}$

$tan\,\Phi = \sqrt{3}\frac{(10.5-10.5)}{(10.5+10.5)}$

$\therefore \Phi = 0°$

Power factor = cos Φ = cos0° = 1

S40. Ans.(c)

Sol. Alternators driven by steam turbines.