
ELECTRICAL ENGINEERING

PRACTICE SET-1

Q.1:- The resistance of a strip of copper of rectangular cross-section is 2Ω . A metal of resistivity twice that of copper is coated on its upper surface to a thickness equal to that of copper strip. The resistance of composite strip will be

- (a) 6Ω (b) $4/3\Omega$ (c) $3/2\Omega$ (d) $3/4\Omega$

Q.2:- The electric field lines and equipotential lines

- (a) Are parallel to each other.
(b) Are one and the same.
(c) Cut each other orthogonally.
(d) Can be inclined to each other at any angle.

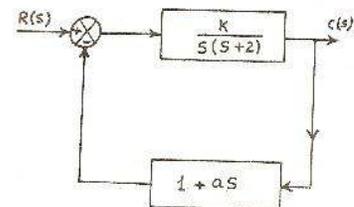
Q.3:- For an SCR, di/dt protection is achieved through the use of

- (a) R in series with SCR.
(b) L in series with SCR.
(a) RL in series with SCR.
(c) RLC in series with SCR.

Q.4:- In a linear system, an input of $5 \sin \omega t$ produces an output of $10 \cos \omega t$. The output corresponding to input $10 \cos \omega t$ will be equal to

- (a) $+ 5 \sin \omega t$ (b) $- 5 \sin \omega t$ (c) $+ 20 \sin \omega t$ (d) $- 20 \sin \omega t$.

Q.5:- For the system shown in figure, with a damping ratio ζ of 0.7 and an undamped natural frequency ω_n of 4 rad / sec, the values of K and a are



- (a) $K = 4, a = 0.35$
(b) $K = 8, a = 0.455$
(c) $K = 16, a = 0.225$
(d) $K = 64, a = 0.9$

Q.6:- A single instruction to clear the lower four bits of the accumulator I 8085 assembly language is:

- (a) XRI OHF (b) ANI FOH (c) XRI FOH (d) ANI OFH.

Q.7:- The p-type substrates in a conventional pn-junction isolated integrated circuit should be connected to:

- (a) Nowhere, i.e., left floating.
(b) A dc ground potential.
(c) The most positive potential available in the circuit.
(d) The most negative potential available in the circuit.

Q.8:- The velocity of electromagnetic radio waves is

- (a) 3 x
(b) 3 x
(c) 3 x
(d) 3 x

Q.9:- A certain 8-bit microprocessor executes "SUB A, B" by loading B to the ALU, then loading A to the ALU, Subtracting A from B, and storing the result in B. Which of the following instructions would cause the ZERO flag to be set?

- (a) SUB (X), (X) +
(b) SUB (X), (X) +
(c) SUB (X), (X)
(d) all of the above

Q.10:- which of the following induction motor will have the least shaft diameter?

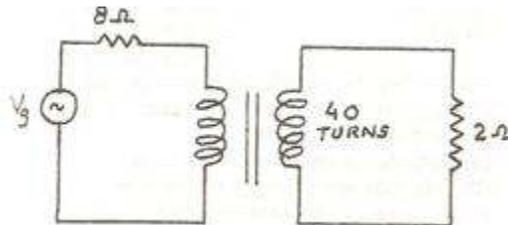
- (a) 20 HP, 2880 rpm
(b) 20 HP, 1440 rpm
(c) 20 HP, 960 rpm
(d) 20 HP, 730 rpm

Q.11:- In 'plasma' state a gas

- (a) (a) loses electrical conductivity
(b) (b) attracts moisture
(c) (c) becomes perfect dielectric medium
(d) (d) conducts electricity

Q.12:- If the secondary winding of the ideal transformer shown in the figure below, has 40 turns, the number of turns in the primary winding for maximum power transfer to the 2 ohm resistor will be

IDEA TRANSFORMER



- (a) 20 (b) 40 (c) 80 (d) 160

Q.13:- A 6 pole 3-phase wound-rotor induction machine is driven by another machine at 1800 rpm. The rotor of the induction machine is connected to a 50Hz system. If the mechanical rotation of the rotor is in the same direction as the rotor winding flux rotation, then frequency of the stator voltage will be

- (a) 50Hz (b) 140 Hz (c) 150 Hz (d) 200 Hz

Q.14:- A universal motor runs at

- (a) Higher speed will dc supply and with less sparking.
(b) Higher speed with ac supply with less sparking.
(c) Same speed both ac and dc supplies.
(d) Higher speed with ac supply but with increased sparking at the brushes.

Q.15:- Two 550 kVA alternator operate in parallel to supply the following loads

- I. 250 KW at 0.95 p.f. lagging
II. 100 KW at 0.85 p.f. leading

One machine is supplying 200 KW at 0.9 p.f. lagging. The p.f. of other machine must be

- (a) 0.89 leading (b) 0.95 leading (c) 0.95 lagging
(d) 0.89 lagging

Q.16:- In a 110 volts compound generator, the armature, shunt and series windings are 0.06 ohm, 27.5 ohm and 0.04 ohm respectively. The load consists of 200 lamps; each rated at 55 W, 110 V. find the total e.m.f. when the machine is connected for long shunt operation.

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- (a) ROM is a Read/Write memory.
 - (b) PC points to the last instruction that was executed.
 - (c) Stack works on the principal of LIFO.
 - (d) All instructions affect the flags.

Q.24:- If a transistor is operation with both of its junctions forward biased, but with the collector forward bias greater than the emitter-base forward bias, then it is operating in ht

- (a) Forward active mode.
- (b) Reverse saturation mode.
- (c) Reverse active mode forward saturation mode.
- (d) Forward saturation mode.

Q.25:- Which type of transmission line will have the maximum value of characteristic impedance?

- (a) Open wire line.
- (b) Twin lead line.
- (c) Coaxial cable.
- (d) All have same impedance.

Q.26:- The ALU of a microprocessor performs operations of 8-bit two's complement operands. What happens the operation $7A_{16} - A2_{16}$ is performed?

- (a) Result = $D8_{16}$ 'Overflow and negative flags set.
- (b) Result = $D8_{16}$ ' Negative flag is set.
- (c) Result = $D8_{16}$ 'No flags set.
- (d) Result = 28_{16} 'overflow flag set.

Q.27:- Efficiency of a plant is secondary consideration for

- (a) Base load power plants.
- (b) Peak load power plants.
- (c) Both peak loads as well as base load power plants.
- (d) Neither peak load nor base load power plants.

Q.28:- An undesirable side effect of motional inductance of large conduction specimens is

- (a) Skin effect
- (b) hysteresis
- (c) eddy currents
- (c) dielectric loss

Q.29:- if the rated voltage from the power lines is applied to the primary of a single-phase transformer which is operated on no-load, then

- (a) Both input voltage and current are sinusoidal.
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- (b) Both input voltage and current are non-sinusoidal.
- (c) Input voltage is non-sinusoidal and input current sinusoidal.
- (a) D input voltage is sinusoidal and input current is non sinusoidal.

Q.30:- “In all cases of electromagnetic induction, an induced voltage will cause a current to flow in a closed circuit in such a direction that the magnetic field which is caused by that current will oppose the change that produces the current” is the original statement of

- (a) Lenz’s law
- (b) Faraday’s law of magnetic induction.
- (c) Fleming’s law of induction
- (d) Ampere’s law

Q.31:- The sator and rotor pole number may be different in a

- (a) Pole changing induction motor.
- (b) Reluctance motor.
- (c) Repulsion motor.
- (d) Synchronous motor.

Q.32:- Match List-1 with List-2 and select the correct answer using the codes given below the lists:

List-1

List-2

(Parts of a tubogenerator used in thermal power plants are made)

(Materials from which these parts

- (a) A. Steel core
- (b) B. Rotor core
- (c) C. Stator windings
- (d) D. Slip rings

- 1. Copper
- 2. Copper alloy
- 3. Silicon steel
- 4. Mild steel
- i. 5. Aluminum

Codes:-

- (a) A B C D
 3 5 2 1
- (b) A B C D
 4 5 1 2
- (c) A B C D
 4 3 1 2
- (d) A B C D

3 4 1 2

Q.33:- The type of dc generator used for arc welding purposes is a

- (a) Series generator.
- (b) Shunt generator.
- (c) Cumulatively compounded generator.
- (d) Differentially compound generator.

Q.34:- In power station practice “spinning reserve” is

- (a) Reserve generating capacity that is in operation but not in service.
- (b) Reserve generation capacity that is connected to bus and ready to take the load.
- (c) Reserve generating capacity that is available for service but not in operation.
- (d) Capacity of the part of the plant that remains under maintenance.

Q.35:- A load that has a resistance of 10 ohms is to be connected to a supply that has a constant voltage of 120 volts. If it is desired that the current to the load be varied from 3 to 5 amperes, what are the resistance and the current rating of the series rheostat that permit this variation?

- (a) (a) 5 ohms, 5 A (b) 10 ohms, 10 A
- (b) (c) 20 ohms, 10 A (d) 20 ohms, 10 A

Q.36:- Maxwell’s divergence equation for the magnetic field is given by

- (a) (a) $\nabla \cdot \mathbf{B} = 0$ (b) $\nabla \cdot \mathbf{B} = \mu_0 \rho_m$
- (b) (c) $\nabla \cdot \mathbf{B} = \mu_0 \rho_m$ (d) $\nabla \cdot \mathbf{B} = 0$

Q.37:- When a line commutated converter operates in the inverter mode

- (a) It draws both real and reactive power from the A.C. supply.
- (b) It delivers both real and reactive power to the A.C. supply.
- (c) It delivers real power to the A.C. supply.
- (d) It draws reactive power from the A.C. supply.

Q.38:- Match List-1 with List-2 and select the correct answer using the codes given below the lists:

List-1

List-2

(Parameter measured)

(Bridge)

- A. Audio frequency
- B. High Q inductor
- C. Dielectric loss
- D. Low Q inductor

- 1. Maxwell bridge
- 2. Hay bridge
- 3. Wien bridge
- 4. Schering bridge

Codes:

- (a) A B C D
 3 4 2 1
- (b) A B C D
 3 2 4 1
- (c) A B C D
 4 2 1 3
- (d) A B C D
 1 4 2 3

Q.39:- Match List-1 with List-2 and select the correct answer using the codes given below the lists:

List-1

List-2

(Time functions)

(Laplace transforms)

- A. $E^{-2}(t-2)$
- B. —
- C. $t/2$

- 1. —
- 2. —
- 3. —
- 4. —

Codes:

- (a) A B C
 2 1 3
- (b) A B C
 2 3 4
- (c) A B C
 1 2 3
- (d) A B C
 3 1 4

Q.40:- What is the distance of the following code?

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

Q.41:- The common-emitter short-circuit current gain of a transistor

- (a) Is a monotonically increasing of the collector current I_c .
- (b) is a monotonically decreasing function
- (c) Increases with I_c for low I_c , reaches a maximum, and then decreases in I_c .
- (d) is not a function of

Q.42:- Which of the following is circularly polarized antenna?

- (a) Helical reflector
- (b) yogi.uda
- (c) Small circular loop
- (d) Parabolic

Q.43:- A single instruction to clear the lower four bits of the accumulator in 8085 assembly language is:

- (a) XRI OFH
- (b) ANI FOH
- (c) XRI FOH
- (d) ANI OFH

Q.44:- Which of the following equipment would need high starting torque as compared to running torque?

- (a) Lathe machine
- (b) Electric Locomotive
- (c) Centrifugal pump
- (d) Reciprocating compressor.

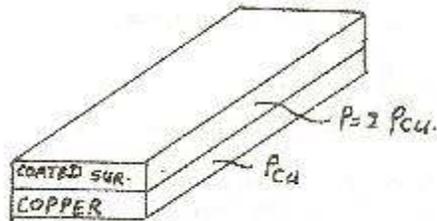
Q.45:- All of the following comparisons between metals and metal alloys and ceramics are true except

- (a) ceramic compounds crystallize more slowly than metallic compounds
- (b) ceramic compounds have higher melting temperatures than metallic compounds
- (c) Metallic compounds are better conductors of current than ceramic compounds at higher temperatures.
- (d) Ceramic compounds are able to resist greater tensile stresses than metallic compounds at room temperatures.

Q.46:- Two 3-phase transformers are to be connected for parallel operation. Which one of the following arrangements is impossible?

- (a) Transformer A: primary Y; secondary Y
Transformer B: primary Δ ; secondary
- (b) Transformer A: primary Δ ; secondary Y

1:-(b) Copper and coated metal strips have resistance of 2 ohms and 4 ohms respectively. These two strips are in parallel. Hence the resistance of the composite strip will be $(2 \times 4) / (2+4) = 4/3$ ohms.



2:-(c) Since no electric can exist along any surface, all points of which are at the same potential, electric field lines and equipotential lines are orthogonal to each other.

3 :- (b) For an SCR, di/dt protection is achieved through the used of L in series with SCR. A snubber circuit connected across an SCR is to suppress dv / dt .

4 :- (d) $\sin wt \rightarrow -\cos wt$

Differentiating

$$\cos wt \rightarrow -2 \sin wt$$

An input of $10 \cos wt$ will cause a

Response of $-20 \sin wt$.

5:- (c) $M(s) = \frac{\quad}{\quad}$
 $= \frac{\quad}{\quad}$

The changed equation is

$$s(s+2) + K(1 + as) = 0 \text{ or } s^2 + s(2+ak) + k = 0$$

$$\text{Compare with } s^2 + 2\delta_n s + \omega_n^2 = 0$$

$$K = 4^2 = 16;$$

$$2 = (2+ak)$$

$$a = \frac{\quad}{\quad} = \frac{\quad}{\quad} = 0.225$$

6:- (b) A single instruction to clear the lower four bits of the accumulator in 8085 assembly language is ANI FOH.

7:- (d) it should be connected to the most negative potential available in the circuit.

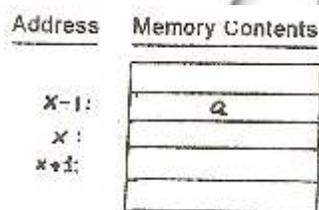
8:- (b) The velocity of electromagnetic wave is 3×10^8 m / s.

9:- (a) Note that

(X) + signifies “locate the operand at location X, and then increment X by 1.”

– (X) signifies “decrement X by 1, and then locate the operand at location old – X minus one.”

Following is a diagram of a section of linear memory containing the location X.



Consider the instruction:

SUB – (X), (X) +

Observe that at both times the same operand, namely a, is being accessed. Since $a - a = 0$ the zero flag will be set.

10:- (a) The horsepower is proportional to the product of rpm (N) and torque (T)

Since the horsepower of all the motors is the same, the motor having highest rpm (2880 in this case) will have least torque. Diameter of the shaft depends on torque, therefore, 20 HP, 2880 rpm motor will have the least diameter of shaft.

11:- (d) in plasma state a gas is fully ionized and it conducts elasticity.

12: (c) For maximum power transfer to 2 ohm resistor, the reflected resistance in the primary circuit should be 8 ohm.

Therefore,

$$— = 2 \text{ so that } R_2' = \left(\frac{1}{2}\right)^2 \times$$

$$\text{Or } R_2 = 2^2 \times 2.8 \text{ ohm}$$

$$\text{Thus, } N_1 = 2 \times 40 = 80 \text{ turns.}$$

13:- (b) $P = 6$, $N_r = 1800 \text{ rpm}$, $f_2 = 50 \text{ Hz}$

Let the stator voltage frequency be f .

$$\text{Then, } f_2 = sf.$$

$$\text{Also, } \frac{N_r}{N_s} = N$$

$$\text{Or } \frac{N_r}{N_s} = N$$

$$\text{Or } \frac{N_r}{N_s} = N, \text{ s being slip}$$

$$\text{Or } s = \frac{N_r}{N_s} \text{ or } (1 - s) = \frac{N_r}{N_s}$$

$$\text{Or } N_s - N_s \cdot s = N_r \text{ or } N_s - N_s \frac{N_r}{N_s} =$$

$$\text{Or } N_s - N_r + 1000 = 1800 + 1000 = 2800$$

$$\therefore f = \frac{2800}{20} = 140 \text{ Hz.}$$

14:- (a) A universal motor runs at higher speed with DC supply and with less sparking.

15:- (a) Total $P = 250 + 100 = 350 \text{ kW}$

$$\text{Total } Q = 250 \tan \cos^{-1} 0.95 - 100 \tan \cos^{-1} 0.85$$

$$= 250 \times 0.3287 - 100 \times 0.6197$$

$$= 82.171 - 61.97 = 20.196 \text{ kVAR}$$

$$= 200 \tan \cos^{-1} 0.9 = 96.86 \text{ kVAR}$$

$$= \text{the reactive power of the other machine is } 20.196 - 96.86 = -76.67 \text{ kVAR}$$

The second machine will operate at leading

p.f. P_2 of this machine is

$$350 - 200 = 150 \text{ kW}$$

$$\cos \phi_2 = \tan \cos^{-1} \text{ ———}$$

$$= 0.890 \text{ leading.}$$

16:- (d) $r_a = 0.06 \text{ ohm}$

$$= 27.5 \text{ ohm}$$

$$r = 0.04$$

Total load current.

$$= 200 \times \text{ ———} = 100 \text{ A}$$

$$= \text{ ———} = 4 \text{ A.}$$

$$= I_L + I_{sh} = 100 + 4 = 104 \text{ A}$$

$$\text{emf} = 110 + 104 (0.06 + 0.04) = 120.4 \text{ V.}$$

17:- (c) Bagasse is fibrous portion of sugarcane left after extracting the juice.

18:- (c) For the present problem, the readers should consider armature as a copper conduction through which the current flows.

We know that for copper

$$\alpha = 0.00393 \text{ (at } 20^\circ\text{C)}$$

$$\text{Hence, } R_{80} = [1 + \alpha (80 - 20)]$$

$$= R_{20} + R_{20} \cdot \alpha \times 60$$

$$\text{ ———} = 0.00393 \times 60 = 2.358$$

Hence percentage change in the value of the resistance = 23.58%.

19:- (c) This is a simple and standard derivation to show that magnetic flux density B around an infinitely long straight filamentary wire carrying a current I is $\mu I / 2\pi R$ where R is the perpendicular distance of the point of intersection from the wire.

20:- (a) In Zener diode the carriers are accelerated by electric field. When they collide with atoms they ionize the atoms due to their kinetic energy. Hence an avalanche break down occurs due to the large increase in the number of carriers.

21:- (c) $= 100 \text{ ohm} \pm 5 \text{ ohm}$,

$$R = 150 \text{ ohm} \pm 15 \text{ ohm}$$

$$R = R_1 + R$$

The errors are specified at standard deviations or are probable errors. In this case,

$$\begin{aligned} R &= \pm \sqrt{\quad} \\ &= \pm \sqrt{5} \\ &= \pm \sqrt{250} \\ &= \pm 15.8 \text{ ohms.} \end{aligned}$$

22:- (b) The unit step response is the integral of unit impulse response.

Unit step response

$$\begin{aligned} &= \int_0^t [-4 e^{-t} + 6 e^{-2t}] dt \\ &= 4 e^{-t} - 3 e^{-2t} - 1 \\ &= 4 e^{-t} - 3 e^{-2t} - 1 \end{aligned}$$

23:- (c) Stack works on the principle of LIFO is the true statement.

24:- (b) It is operating in the reverse saturation mode.

25:- (b) The characteristic impedance Z_0 , for various types of transmission line sins given below:

Transmission Line	Z_0
Open – wire line	300 – 600 Ω
Twin – lead line	250 – 300 Ω
Coaxial cable	50 – 75 Ω

26:- (a) 7 A 0111 1010 0111 1010

-A2	-1010 0010	+ 0101 1110
		1101 1000

Result = $D8_{16}$.

Sign bit = 1, so negative flag set. The sign of the result is the same as the sign of the number subtracted; thus. Overflow flag set.

27:- (b) Main purpose of peak load plant is to meet the peaked demand. Such plants normally run for short durations and, therefore, their efficiency is a secondary consideration.

28:- (c) When a conductor is moved towards the north pole of a bar magnet, it will experience a change of magnetic flux as a result of which there will be an induced emf. This emf will give rise to an induced current in the conductor, in a direction (determined by Lenz's law) that will oppose the movement of the conductor. Such currents are called eddy currents.

In general, eddy currents occur in conductors that experience a change of flux. This flux change can be due either to the mechanical motion in a magnetic field as in the armature of a motor, or to a changing current in the wires wound around the soft iron core of a transformer. In both cases, eddy currents cause $i^2 R$ losses due to heating. These can be minimized by laminating the iron core, i.e., building it up with thin sheets covered by a thin coating of insulating varnish. This reduces the eddy currents.

29:- (d) Magnetizing current is usually non-sinusoidal at the flux density values normally used; and under no load condition, the total current comprises magnetizing current and core loss component correct.

30:- (a) Lenz's law

30:- (b) Reluctance motor.

32:- (d) A - 3, B - 4, C - 1, D - 2.

33:- (d) As the terminal voltage should fall with increase in the arc current for welding work, the differentially compounded generator is quite suited for this purpose.

34:- (b) In power station practice "spinning reserve" is to reserve generating capacity that is connected to bus and ready to take the load.

35:- (c) The 10 ohm load when connected to 120 V supply will take a current of $120/10 = 12A$ without rheostat in the circuit. Since it is desired to restrict the current flow through the load at 3 to 5 amperes, the voltage drop in the load will be

$3 \times 10 = 30$ volts at 3 amperes, and

$5 \times 10 = 50$ volts at 5 amperes

When the voltage drop across the load is 30 V, the voltage drop in the rheostat must be $120 - 30 = 90$ volts. Since the same current flows through the rheostat, the resistance of the rheostat must be $90 / 3 = 30$ ohms.

When the voltage drop across the load is 50 V, the voltage drop in the rheostat must be $120 - 50 = 70$ volts. Since the same current flows through the rheostat, the resistance of the rheostat must be $70 / 5 = 14$ ohms. Thus rating of rheostat must be 30 ohms and 5 amperes.

36:- (b) No explanation needed something standard and evident as the net magnetic flux through any closed surface is always zero. $\nabla \nabla \nabla$

37:- (c) A line commutated converter operates, in the rectifying mode converting ac to dc for the first 0° to 90° and in the inverting mode for phase angles 90° to 180° . When the dc voltage is negative power flow is from dc to ac and the converter functions as inverter. As dc power is fed back it is real power.

38:- (b) A – 3, B – 2, C – 4, D - 1

39:- (a) A – 2, B – 1, C – 3

40:- (a) Two

41:- (c) The common emitter short-circuit current gain of transistor increases with β for low β reaches a maximum, and then decreases with further increase in β .

42:- (a) only a helical antenna is the circularly polarized antenna.

43:- (b) ANI FOH

An accumulator is a register in which the result of an arithmetic or logic operation is formed.

44:- (b) only locomotive needs starting torque more than the running torque

45:- (d) Ceramic materials are more brittle than metals. Ceramic materials are able to resist enormous shear stresses. The tension and compression strength of the ceramic materials are not comparable due to the enormous shear resistance. Under a tensile load the stress will be concentrated at cracks and flaws in the ceramic material. A more ductile material will be able to lower the stress concentration through plastic deformation. However, if plastic deformation cannot occur due to high shear resistance, the stress concentration will continue to increase as the load increases. The crack will extend and a brittle fracture will take place.

46:- (b) Even (c) is possible because we can have the phase group as yd 1 and Dy 1 or yd 11 and Dy 11. (b) is impossible because there shall be a phase difference of 30° in the voltages of the corresponding phases of the two-transformers on the secondary side.

47:- (b) Rotor frequency $f_2 = 0.5$ H;

$$f_2 = sf$$

$$s = \frac{f_2}{f} = 0.01$$

$$n_s = \frac{120f}{p} = \frac{120 \times 1000}{120} = 1000$$

$$n_r = n_s (1 - s)$$

$$= 1000 (1 - 0.01) = 990 \text{ rpm}$$

48:- (d) Out of the given range of motors, motor at (d) will require highest torque. Therefore, capacitor in the auxiliary winding for this motor would have the largest value.

49:- (b) Thermal power plant generators are invariably high speed machines. Nuclear power plants also use similar machines with the only difference in the source of energy. Hydroelectric power plants are invariably low speed machines therefore, choice (b) is appropriate.

50:- (c) Motor:

$$E_{bm} = V - (I_a R_a + I_a X_a)$$

$$= 220 - (20 + 20 \times 0.5)$$

Gen.:

$$E_{by} = V + (I_a R_a + I_a X_a)$$

$$= 220 + (20 + 20 \times 0.5)$$

$$E_{by} - E_{bm} = 40 \text{ V.}$$

