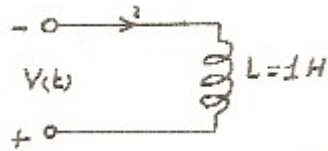


# ELECTRICAL ENGINEERING

## PRACTICE SET- 5

Q1. If in the circuit shown,  $v(t) = t$ . the current  $I(t)$  will be a



- (a) Ramp function
- (b) Step function
- (c) Impulse function
- (d) Doublet

Q2. A metal sphere with 1 m radius and a surface charge density of 10 Coulombs /  $m^2$  is enclosed in a cube of 10m side. The total outward electric displacement normal to the surface of the cube is

- (a) 40 Coulombs
- (b) 10 Coulombs
- (c) 5 Coulombs
- (d) None of the above.

Q3. The main reason for connecting a pulse transformer at the output stage of a thyristor triggering circuits to

- (a) Amplify the power of the triggering pulse.
- (b) Provide electrical isolation
- (c) Reduce the turn on time of the thyristor
- (d) Avoid spurious triggering of the thyristor due to noise.

Q4. A simple dc potentiometer is to be standardized by keeping the side wire setting at 1.0813 V. If by mistake, the setting is at 1.0138 V and the standardization is made to obtain a source voltage of 1.0318 V, then the reading of the potentiometer will be

- (a) 1.0138 V
- (b) 1.0183 V
- (c)  $(1.0138)^2 / 1.0183$  V
- (d)  $(1.0138)^2 / V$ .

Q5. The maximum phase shift that can be obtained by using a lead compensator with transfer function

$$G_c(s) =$$

Is equal to:

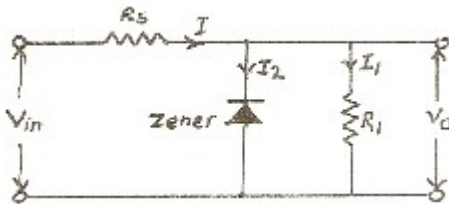
- (a) Improve relative stability.
- (b) Increase the speed of response.
- (c) Increase bandwidth.
- (d) Increase overshoot.

Q6. Storage of 1 KB means the following number of bytes:

- (a) 1000
- (b) 964
- (c) 1024
- (d) 1064.

Q7. Consider the following statements regarding the circuit given in the figure, where the output voltage is constant:

- 1. The voltage at which the Zener breaks down.
- 2. The difference between 1 and the current at which the Zener breaks down.
- 3. The Zener nominal resistance.



Of these statements:

- (a) 1, 2 and 3 are correct.
- (b) 1 and 2 are correct.
- (c) 2 and 3 are correct.
- (d) 1 and 3 are correct.

Q8. High intermediate frequency in a superheat receiver

- (a) Increases tracking problems.
- (b) Reduces adjacent channel rejection.

(c) Improves selectivity.

(d) None of the above.

Q9. In a 16-bit microprocessor, words are stored in two consecutive memory locations. The entire word can be read in one operations provided the first

(a) Word is even.

(b) Word is odd.

(c) Memory location is odd.

(d) Memory address is even.

Q10. Polythene is

(a) A polymer of ethylene.

(b) Vulcanized rubber.

(c) Impregnated cotton.

(d) Cellulose derivative.

Q11. Above the Curie temperature, the hysteresis loop of a ferroelectric material can be described by a

(a) Inversely proportional to temperature and proportional to the square of the permanent dipole moment.

(b) Proportional to temperature as well as to the square of the permanent dipole moment.

(c) Proportional to temperature and inversely proportional to the square of the permanent dipole moment.

(d) Inversely proportional to temperature as well as to the square of dipole moment.

Q12. A 3-phase step down transformer is connected to 6.6 KV mains and takes 10A. For which of the following connection the secondary line current will be least?

(a) Delta – Delta

(b) Star – Star

(c) Delta – Star

(d) Star – Delta.

Q13. In an induction motor, if the air gap is increased

(a) Speed will reduce.

(b) Efficiency will improve

(c) Power factor will improve

(d) Breakdown torque will reduce.

Q14. Which of the following are the features of a shaded pole motor?

1. Salient-pole stator.
2. Uniform air-gap
3. Two stator windings one of which is a short-circuited ring.
4. Squirrel cage rotor.

Select the correct answer using the codes given below:

Codes:-

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

Q15. In a synchronous machine in case the axis of field flux is in line with the armature flux, then

- (a) The machine is working as synchronous motor.
- (b) The machine is working as synchronous generator.
- (c) The machine is said to be floating.
- (d) The machine will vibrate violently.

Q16. A cumulatively compound dc generator is supplying 20 a at 200 V. Now if the series field winding is short circuited, the terminal voltage will

- (a) Remain unaltered at 200 V
- (b) Rise to 220 V
- (c) Shoot up to a high value
- (d) Will reduce to 150 V.

Q17. An ACSR conductor having 7 steel strands and 24 aluminum conductor surrounding the steel strands is called

- (a) 24 / 7 ACSR
- (b) 7 / 24 ACSR
- (c) 41 / 7 ACSR
- (d) 7 / 31 ACSR

Q18. The current through a series RL circuit is when excited by a unit impulse voltage.

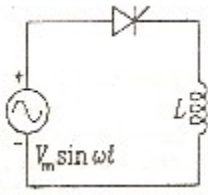
The values of R and L are respectively,

- (a) 8,4
- (b) 4,2
- (c) 2,4
- (d) 1,4

Q19. The critical frequency of an ionosphere layer is 10 MHz. What is the maximum launching angle from the horizon for which a 20 MHz wave will be reflected by the layer?

- (a)  $0^\circ$
- (b)  $30^\circ$
- (c)  $45^\circ$
- (d)  $90^\circ$

Q20. A half-wave thyristor converter supplies a purely inductive load, as shown in Figure. If the triggering angle of the thyristor is  $120^\circ$ , the extinction angle.



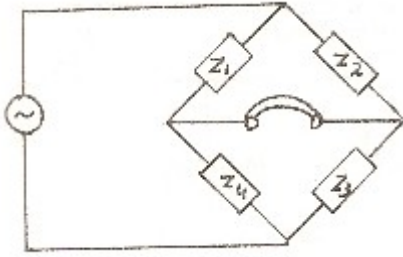
- (a)  $240^\circ$
- (b)  $180^\circ$
- (c)  $200^\circ$
- (d)  $120^\circ$

Q21. In the ac bridge shown in the figure

$$Z_1 = 450 \text{ ohm,}$$

$$Z_2 = (300 - j600) \text{ ohm,}$$

$$Z_3 = (200 + j100) \text{ ohm.}$$



The value of unknown impedance  $Z_4$  at balance is

- (a)  $(100+j150)$  ohm
- (b)  $(100-j150)$  ohm
- (c)  $(300+j150)$  ohm
- (d)  $(0 +j150)$  ohm.

Q22. Consider the following statements regarding a first order system with a proportional (P) controller which exhibits an offset to a step input:

1. Increase the gain of the P controller.
2. Add derivative mode.
3. Add integral mode.

Of these statements:

- (a) 1, 2 and 3 are correct
- (b) 1 and 2 are correct
- (c) 2 and 3 are correct
- (d) 1 and 3 are correct

Q23. Which of the following is a CORRECT definition of volatile memory?

- (a) It loses its contents at high ambient temperatures.
- (b) Its contents are lost on failure of power supply.
- (c) It has to be kept in air-tight boxes always.
- (d) It is the latest type of bubble memory.

Q24. The ideal characteristic of a stabilizer is

- (a) Constant output voltage with low internal resistance.
- (b) Constant output with low internal resistance.
- (c) Constant output voltage with high internal resistance.

(d) Constant internal resistance with variable output voltage.

Q25. For a signal amplitude modulated to a depth of 100% by a sinusoidal signal, the power is

- (a) Same as
- (b) Twice as
- (c)  $3/2$  times
- (d)  $2/3$ .

The power of unmodulated carrier

Q26. Block search is used to locate a record in an ordered file consisting of N records. The optimum size of the block is

- (a)
- (b)  $3$
- (c)  $N/2$
- (d)  $N/3$

Q27. Polyvinyl acetates are used as

- (a) Solvents
- (b) Adhesives
- (c) Colouring agents
- (d) Hygroscopic substances.

Q28. Orientational polarization is

- (a) Inversely proportional to temperature and proportional to the square of the permanent dipole moment.
- (b) Proportional to temperature as well as to the square of the permanent dipole moment.
- (c) Proportional to temperature and inversely proportional to the square of the permanent dipole moment.
- (d) Inversely proportional to temperature as well as to the square of dipole moment.

Q29. For 100% efficient transformer if the number of turns in the primary and secondary are 1000 and 100 respectively and the input to the transformer is 100 W, the power output is

- (a) 100 W
- (b) 1000
- (c) 10 kW

(d) 100 kW

Q30. The air gap between stator and armature of an electric motor is kept small in order to

- (a) Provide adequate air for cooling the rotor winding
- (b) Facilitate high speed operation without vibrations.
- (c) Reduce the noise
- (d) Provide stronger magnetic field.

Q31. Match List-1 (Type of motor) with List-2 (Applications) and select the correct answer using the codes given below the lists:

List-1

List-2

- |                           |                |
|---------------------------|----------------|
| A. Shaded pole motor      | 1. Robotics    |
| B. Capacitor motor        | 2. Rockets     |
| C. Permanent magnet motor | 3. Ceiling fan |
| D. Stepper motor          | 4. Table fan   |

**Codes:**

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

Q32. If other factors remain constant, the speed of a synchronous motor in its operating (and load) range is correctly described by which of the following?

- (a) The speed varies directly only in proportion to the number of poles.
- (b) The speed is independent of the frequency of the voltage supply
- (c) The speed depends on the frequency of the voltage supply and the number of its poles.
- (d) The speed depends on the magnitude of the voltage supply and the number of its poles.

Q33. A dc armature having 1152 lap connected conductors carrying 120 A rotates at 250 rpm. If the machine has 12 pole fields with flux per pole 0.075 wb, the power output of the armature will be

- (a) 21.5 KW
- (b) 43 KW
- (c) 86 KW
- (d) 172 KW.

Q34. Fault diverters are basically

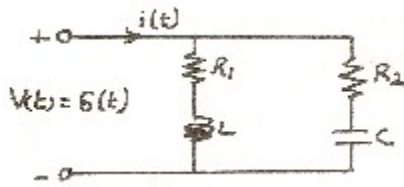
- (a) Circuit breakers
- (b) Fast switches
- (c) Relays
- (d) Fuses.



Q35. The circuit shown in figure is excited by a unit impulse voltage the current  $I(t)$  is given by

- +

Then  $R_1$ ,  $L$ ,  $R_2$ , and  $C$  are respectively.



- (a) 4, 4, 2, 2
- (b) 2, 2, 4, 4
- (c) 4, 2, 2, 4
- (d) 2, 4, 2, 4.

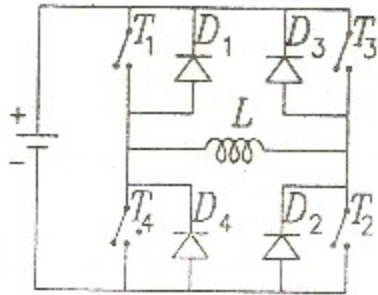
Q36. Following equations hold for time-varying fields:

- (a)
- (b)  $E =$
- (c)  $( =$
- (d)  $=$
- (e)

In the above equations:

- (a) Both  $V$  and  $\mathbf{E}$  are completely defined and thus can be evaluated
- (b)  $\mathbf{E}$  is completely defined but not  $V$ .
- (c)  $V$  is completely defined but not  $\mathbf{E}$ .
- (d) Both  $\mathbf{E}$  and  $V$  are not completely defined.

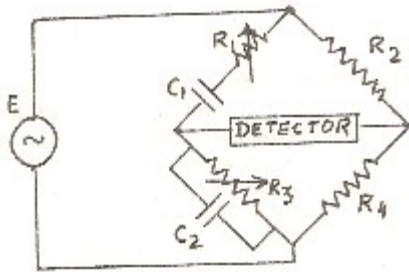
Q37. A single-phase full-bridge voltage source inverter feeds a purely inductive load, as shown in Figure, where  $T_1, T_2, T_3, T_4$ , are power transistor and  $D_1, D_2, D_3, D_4$ , are feedback diodes. The inverter is operated in square-wave mode with a frequency of 50 Hz. If the average load current is zero, what is the time duration of conduction of each feedback diode in a cycle?



- (a) 5 msec
- (b) 10 msec
- (c) 20 msec
- (d) 2.5 msec

Q38. Which of the following conditions are to be satisfied in the figure shown, so that the common variable shaft of resistance  $R_1$  and  $R_2$  can be graduated in frequency to measure the frequency of  $E$  under balanced condition?

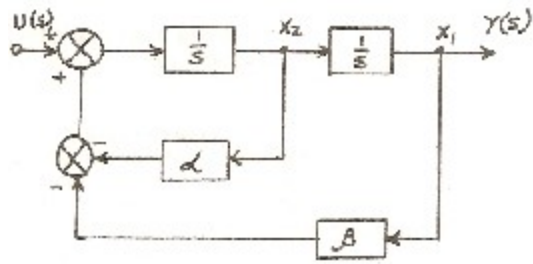
1.  $R_1 = R_3$
2.  $C_1 = C_3$
3.  $R_2 = 2R_4$
4.  $R_2 = R_4$



Select the correct answer using the codes given below:

- (a) 1 and 4
- (b) 1 and 2
- (c) 2 and 4
- (d) 1, 2 and 3.

Q39. Consider the closed loop system shown in the given figure:



The state model of the system is

(a)

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ -\beta & -\alpha \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

$$y = [1 \ 0] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

(b)

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -\beta & -\alpha \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

$$y = [1 \ 0] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

(c)

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ -\beta & -\alpha \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

$$y = [1 \ 0] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

(d)

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -\alpha & -\beta \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

$$y = [1 \ 0] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Q40. Which of the following descriptions relates to a floppy diskette?

- (a) 9-track 1600 BPI
- (b) Double – sided double density
- (c) 33 Mhz – zero - wait time

(d) 40 MB capacity.

Q41. Silicon diode is less suited for low voltage rectifier operation, because

- (a) It can withstand high temperatures
- (b) Its reverse saturation current is low
- (c) Its cut-in voltage is high
- (d) Its break down voltage is high.

Q42. A carbon microphone is a variable

- (a) Resistance device
- (b) Inductance device
- (c) Capacitance device
- (d) None of the above.

Q43. If we use 3 bits in the instruction word to indicate if an index register is to be used and if necessary, which one is to be used, then the number of index registers to be used in the machine will be

- (a) 3
- (b) 6
- (c) 7
- (d) 8

Q44. A stepper motor

- (a) Is a two phase induction motor
- (b) Is a kind of rotating amplifier
- (c) Is an electromagnetic transducer commonly used to convert an angular position of shaft into an electrical system
- (d) Is an electromechanical device which actuates trains of step angular (or linear) movements in response to a train of input pulses on one to one basis

Q45. Match List-1 with List-2 and select the correct answer using the codes given below the list:

**List – 1**

- A. Electrostriction
- B. Piezoelectric
- C. Ferro electricity
- D. Dielectric

**List – 2**

- 1. Polarization is a linear function of the applied field
- 2. Polarization is a nonlinear function of applied field
- 3. Mechanical distortion produces polarization
- 4. Mechanical distortion does not produce polarization.

**Codes:**

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

Q46. Under operating conditions the secondary of a current transformer is always short circuited because

- (c) It protects the primary circuit
- (d) It is safe to human beings
- (e) It avoids core saturation and high voltage induction
- (f) None of the above.

Q47. An electric machine will have high efficiency when

- (a) Input / output ratio is low
- (b) Reactive power is more.
- (c) kWh consumption is low
- (d) Losses are low.

Q48. A 1.8° step, 4-phase stepper motor has a total of 40 teeth on 8 poles of stator. The number of rotor teeth for this motor will be

- (a) 40
- (b) 50
- (c) 100
- (d) 80

Q49. While starting a synchronous motor by induction motor action vary high emf is induced in the field. This induced emf may damage the insulation of the field winding and the slip rings. The insulation damage can be prevented by

- (a) Short-circuiting the field winding by field discharge resistance
- (b) Splitting the field winding into several sections
- (c) Either of (a ) or (b)
- (d) None of the above.

Q50. DC series motors are preferred for traction due to

- (a) Continuous long runs
- (b) Near full load operation
- (c) High starting torque
- (d) High efficiency and low cast.

**Solution**

1:- (b)  $v(t) =$  Therefore,

$$1 = I(s)SL + SI(s). I(s) = 1/s$$

$$I(t) = \text{unit step function.}$$

2:- (a)  $D = q \cdot 4$

$$= 10 \times 4$$

$$= 40 \text{ Coulombs.}$$

3:- (d)

4:- (c) The setting of the potentiometer is at 1.0138 instead of 1.0813. Therefore, the working current in the slide wire is more than what it would have been if the setting was at 1.0813, i.e. the correct value for applied voltage of 1.0813 V,

=

If the setting is at 1.0138 and the applied voltage is also 1.0138, the standardization is then correct. (Statement of the problem appears ambiguous).

5:- (b) For phase-shift, only

Is important. It is identified that  $T = 0.05$  and

$ST = 0.15$   $a = 3$

Maximum phase shift is given by  $\phi$  such that

$\tan \phi = \frac{a}{ST} = \frac{3}{0.15} = 20$

$\phi = 30^\circ$ .

6:- (c) Storage of 1 KB means 1024 bytes.

7:- (b) Statement 1 and 2 are correct.

8:- (a) Higher intermediate frequency in a superheterodyne receiver increases tracking problems.

9:- (d) The entire word can be read in one operation provided the first memory address is even.

10:- (a) Polythene is a polymer of ethylene.

11:- (b) Relation between  $\chi_r$  and temp T is

$\chi_r = \frac{C}{T - T_c}$  (Curie-Weiss Law)

$\chi_r$  = relative permittivity of the material

T = temperature of the material

C = Curie constant

$T_c$  = Curie temperature

The above relation represents neither a point, nor a straight line and nor a parabola. Hence the curve is a cycloid.

12:- (c) Secondary line current for four given connections will be

<u>Connection</u>	<u>Current</u>
Delta – Delta	120 A
Star – Star	120 A

Delta – Star                      69.3 A

Star – Delta                      208 A,

13:- (c) More magnetizing ampere turns would be needed to set up the same flux because of the increased air gap length. Magnetizing current is responsible for low power factor.

14:- (c) 1, 3 and 4

15:- (c) The machine is said to be floating.

16:- (c) When series field winding is short-circuited the terminal voltage will rise to a high value.

17:- (a) It is called 27 / 7 ACSR.

18:- (c)  $1 = (R + SL)$

$$R = 2$$

$$1: L = 4.$$

19:- (b)  $f_c = 10 \text{ MHz}$

$$\text{MUF} = \text{Sec } f_c$$

$$20 = 10 \times \text{Sec}$$

$$\text{Sec}$$

Therefore  $= 60^\circ$  (angle of incidence) hence, launching angle is equal to

$$108 - (90 + 60) = 30^\circ.$$

20:- (d) Out put current is given by

Where  $Z =$

Line  $R = 0,$

From the figure,

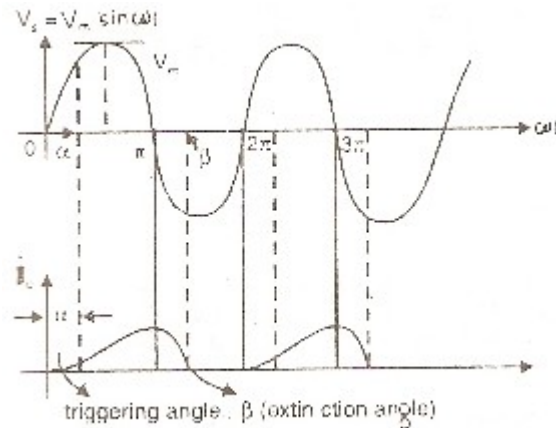
At (extinction angle)

$$i_o = 0$$

Hence, from equation (i)

(Triggering angle)

Hence,



21:- (d) The balance condition can be applied and the resulting equation solved.

$$Z_1 Z_3 = Z_2 Z_4$$

$$450 (200 + j100)$$

$$= (300 - j600) (R_4 + j4) 9000 + j45000$$

$$= (300R_4 + 600 \times 4) + j(300 \times 4 - 600R_4)$$

$$X_4 = (150 - 0.5R_4)$$

$$X_4 = 150 \text{ or } Z_4 = j150 \text{ ohm.}$$

22:- (b) Statements 1 and 2 are correct.

23:- (b) Its contents are lost on failure of power supply, is a correct definition of volatile memory.

24:- (a) Voltage stabilizer is a Zener diode or other device that suppresses variation in a DC voltage. It is often used in place of capacitor across a cathode biasing resistor.

25:- (c)  $(2 + m^2 / 2)$ . Also,  $m = 1$  for 100% modulation.

26:- (a)

27:- (b) Polyvinyl acetate is used as an adhesive.

28:- (a) Orientation polarization is inversely proportional to temperature and proportional to the square of the permanent dipole moment.

29:- (b) the power output remains unchanged.

30:- (d) Small air gap facilitates stronger magnetic field with least losses.



31:- (d) A – 4, B – 3, C – 3, D - 1

32:- (c) The speed depends on the frequency of the voltage supply and the number of its poles.

33:- (c) Generated emf,

$$E_g = \quad \times$$

=

$$= 360 \text{ V.}$$

$$\text{Power output} = \quad =$$

$$= 4302 \text{ KW.}$$

34:- (b) These are fast switches.

35:- (d)

From the circuit,

$$I(s) =$$

$$= +$$

$$= - +$$

Comparing with

$$R_2 = 2$$

, giving  $c = 4$

$$L = 4$$

$$R_1 = 2$$

$$2, 4, 2, 2$$

$$R_1 \quad L \quad R_2 \quad C$$

36:- (a) Both V and A are completely defined and thus can be evaluated.

37:- (d) Applying KVL to both the loop,

We get

$$V_1 = R_1 I_1 + M \dots (i)$$

$$\text{And } 0 = \dots (ii)$$

38:- (d) Writing the bridge balance equation:

$$R_4 = R_2 [$$

$$= R_2$$

$$\text{Or } (R_1 + (1+jR_3 C_3 \omega))$$

It gives,

$$R_1 + R_3 =$$

And  $R_1 R_3 C_2 \omega =$  Hence,  $\omega =$

If  $C_1 = C_3$ , the first equation becomes

$$R_1 + R_3 =; \text{ further if } R_1 = R_3$$

And the common variable short of resistance  $R_1$  and  $R_3$  can be graduated in frequency to measure the frequency;  $\omega \propto 1 / R_1$ . Thus conditions to be satisfied are  $C_1 = C_3$ ,  $R_2 = 2R$  and  $R_1 = R_3$ .

39:- (b) it is seen from given Block diagram that

$$Y(s) = x_1(s)$$

$$\text{Or } y = [1 \ 0] [$$

$$\text{Also, } x_1(s) = 1 / 2 x_2(s)$$

$$\text{Or } x_2(s) = s x_1(s) \quad X_2 = X_1$$

$$\text{OR } X_1 = X_2$$

$$\text{Also, } x_2(s) = 1 / s [u(s)]$$

$$\text{OR, } X_2(S) = U(s)$$

u -

$$\text{Thus, } [ = [ [ = [u$$

40:- (b) Double sided density relates to floppy diskette.

41:- (d) Silicon diode is less suited for low voltage rectifier operation, because its breakdown voltage is high.

42:- (a) The original power is 80 W.

43:- (a) 3

44:- (d) A stepper motor is an electro-mechanical device which actuates a train of step angular (or linear) movements in response to a train of input pulse on one to the one basis- one step actuation for each pulses input. A stepper motor is the actuator element of incremental motion control systems – computer peripherals like printers, tape drives, capstan drives, etc.

45:- (c) Polarization may cause mechanical distortion but the reverse does not occur, this is known as electrostriction; polarization causes mechanical distortion and mechanical distortion produces polarization, this is piezoelectric effect; in ferroelectricity phenomenon, applied electric field; and in dielectrics polarization is a linear function of the applied field;

$P = E$ . In the above relation  $E$  is the total field in the material.

46:- (c) Secondary of a current transformer is always short circuited to avoid core saturation and high voltage induction.

47:- (d) The efficiency of an electric machine is given by

Efficiency =

Therefore, the efficiency will be maximum when the losses are less

48:- (b)  $T =$

Where  $n$  = number of phases,

= step angle

49:- (c) It can be prevented by short-circuiting the field winding by field discharge resistance and splitting the field winding into several sections.

50:- (c) Series motor have high starting torque