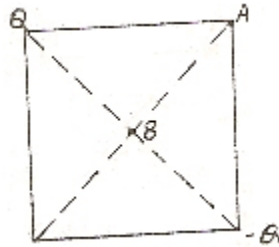


## Electronics-Engineering

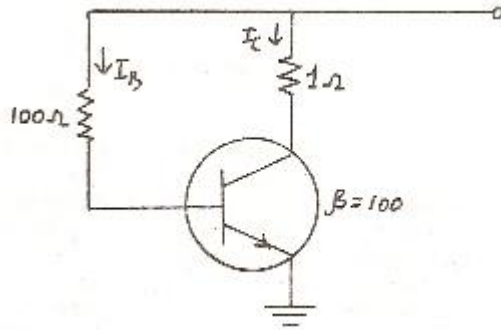
- Two coils in differential connection have self-inductance of 2 mH and 4 mH and a mutual inductance of 0.15 mH. The equivalent inductance of the combination is
  - 5.7 mH
  - 5.85 mH
  - 6 mH
  - 6.15 mH.
- Two point charges  $Q$  and  $-Q$  are located on two opposite corners of a square as shown in figure. If the potential at the corner A is taken as 1V, then the potential at B, the centre of the square will be



- zero
  - $\frac{1}{\sqrt{2}}V$
  - 1V
  - $\sqrt{2}V$
- Optocouplers combine
    - SITs and BJT's
    - IGBTs and MOSFETS
    - Power transformers and silicon transistor
    - Infrared light-emitting diode and a silicon phototransistor
  - The difference between the indicated value and the true value of a quantity is known as
    - Gross error
    - Absolute error
    - Dynamic error
    - Relative error
  - The principles of homogeneity and super-position are applied to :
    - linear time variant systems
    - non-linear time variant systems
    - linear time invariant systems
    - non-linear time invariant systems
  - In a 8085 microprocessor system with memory mapped I / O,
    - I / O devices have 8-bit addresses
    - I / O devices are accessed using IN and OUT instructions
    - there can be a maximum of 256 input devices and 256 output devices.

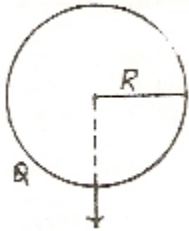
D. arithmetic and logic operations can be directly performed with the I / O data.

7. The transistor shown in figure below, is biased



- A. at cut-off  
B. at saturation  
C. well into saturation  
D. well into cut-off
8. In any transmitting antenna system, efficiency primarily depends upon  
A. ohmic losses of various conductors  
B. radiation resistance  
C. ground conductivity  
D. atmospheric conditions
9. An instruction used to set the carry Flag in a computer can be classified as  
A. data transfer  
B. arithmetic  
C. logical  
D. program control
10. The binary representation of 5.375 is  
A. 111.1011  
B. 101.1101  
C. 101.011  
D. 111.001
11. Dislocations in materials are  
A. point defect  
B. line defect  
C. planer defect  
D. surface defects.
12. In TV system, vertical pulses are separated out from horizontal pulses by the use of  
A. integrator  
B. differentiator  
C. sweep credit  
D. sync separator
13. Frequency in the UHF range propagate by means of  
A. Ground waves  
B. Sky waves

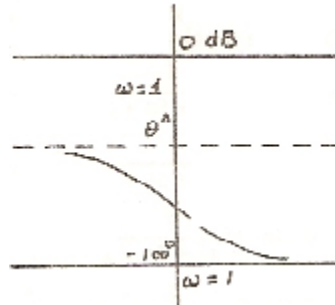
- C. Surface waves  
D. Space waves.
14. 200 MHz may be classified as  
A. VHF  
B. SHF  
C. UHF  
D. EHF
15. A communication satellite is a repeater between  
A. a transmitting station and a receiving station  
B. a transmitting station and many receiving stations  
C. many transmitting stations and many receiving stations  
D. none of the above
16. The power in a series R-L-C circuit will be half of that at resonance when the magnitude of the current is equal to  
A.  $V / 2R$   
B.  $V / \sqrt{3} R$   
C.  $V / \sqrt{2} R$   
D.  $\sqrt{2} V / R$
17. A point charge  $Q$  is located on the surface of a sphere of radius  $R$  as shown in the figure. The average electric field on the surface of the sphere will be



- A. infinite  
B.  $\frac{Q}{4\pi \epsilon_0} \frac{1}{R^2} (-\vec{n})$   
C.  $\frac{Q}{8\pi \epsilon_0} \frac{1}{R^2} (-\vec{n})$   
D. Zero
18. The efficiency of a chopper can be expected in the range  
A. 50 to 55 percent  
B. 65 to 72 percent  
C. 82 to 87 percent  
D. 92 to 99 percent
19. Which one out of the following instruments should be used to measure 600 kV a.c. voltages?

- A. Hot wire instrument
- B. Electrostatic voltmeter
- C. Moving coil voltmeter
- D. Moving iron voltmeter.

20.



Which one of the following transfer functions represents the Bode plot shown in the above figure:

- A.  $G = \frac{1-s}{1+s}$
- B.  $G = \frac{1}{(1+s)^2}$
- C.  $G = \frac{1}{s^2}$
- D.  $G = \frac{1}{s(1+s)}$

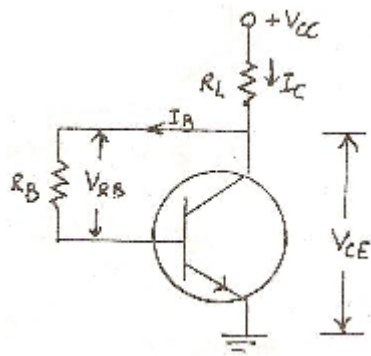
21. The following programme is run on an 8085 microprocessor,

Memory address in Hex	Instruction
2000	LXI SP, 1000
2003	PUSH H
2004	PUSH D
2005	CALL 2050
2008	POP 2050
2009	HIT

As the completion of execution of the program, the program the program counter of the 8085 contains ....., and the stack pointer contains .....

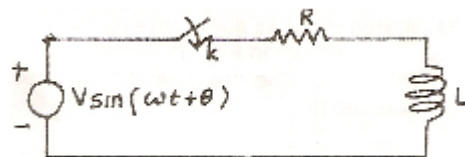
- A. 2050, OFFC
- B. 2251, OFFC
- C. 1025, OCCF
- D. 1025, OCCF

22. With reference to figure, value of  $V_{CE}$  is

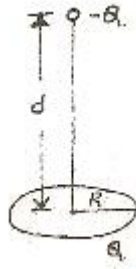


- A. 0 V  
 B. 5 V  
 C. -5V  
 D. none of the above
23. The smallest change in sound intensity that can be detected  
 A. 1 dB  
 B. 3 dB  
 C. 10 dB  
 D. 20 dB.
24. In a generic microprocessor, instruction cycle time is  
 A. shorter than machine cycle time  
 B. larger than machine cycle time  
 C. exactly double the machine cycle time  
 D. exactly the same as the machine cycle time
25. The value of M in the end will be  
 Do 100 I = 1, 2  
 DO 200 J = 1, 2  
 M = M + I + J  
 200 CONTINUE  
 100 CONTINUE  
 STOP  
 END
- A. 10  
 B. 11  
 C. 12  
 D. 14
26. Resistivity of electrical conductors is most affected by  
 A. temperature  
 B. pressure  
 C. composition  
 D. all of the above
27. In CCIR B-system of TV, blanking pulse is placed during  
 A. equalizing pulse

- B. retrace interval between each line  
 C. retrace period of vertical line  
 D. none of the above
28. The polarization required in ground wave propagation is  
 A. Horizontal (linear)  
 B. vertical (linear)  
 C. Circular  
 D. Elliptical
29. Multicavity Klystron  
 A. is not a microwave device  
 B. is not a good low level amplifier because of noise  
 C. is not suitable to pulse operation  
 D. has a high repeller voltage to insure small transit time
30. Transponder comprises of  
 A. Transmitter  
 B. Receiver  
 C. Antenna  
 D. a, b, c combined
31. Consider the following statements regarding the circuit shown in the given figure :
1. If the switch K is closed at a proper instant there will be no transient
  2. The instant at which K is closed such that the transient is zero depends on the frequency of the supply
  3. The instant at which K is closed such that the transient is zero depends on the circuit elements
  4. There will always be a non-zero transient after the switch K is closed.



- Of these statements
- A. 1 alone is correct.
  - B. 1 and 2 are correct.
  - C. 1 and 3 are correct
  - D. 4 alone are correct.
32. A circular ring carrying a uniformly distributed charge  $Q$  and a point charges  $-Q$  on the axis of the ring are shown in the fig. The magnitude of the dipole moment of the charge system is



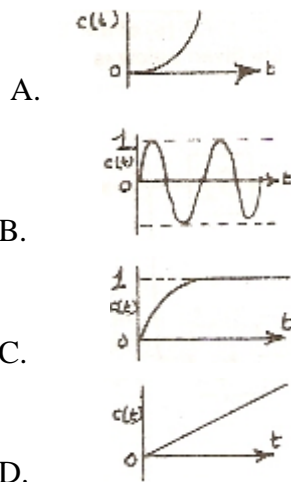
- A.  $Qd$   
 B.  $QR^2/d$   
 C.  $Q\sqrt{R^2+d^2}$   
 D.  $QR$ .
33. Which of the following regulator provides output voltage polarity reversal without a transformer?  
 A. Buck regulator  
 B. Boost regulator  
 C. Buck-boost regulator  
 D. Cuk regulator
34. The deflection of hot wire instrument depends on  
 A. RMS value of alternating current  
 B. voltage  
 C. average value of a.c. current  
 D. instantaneous value of a.c. current
35. Match List-I with List-II and select the correct answer using the codes given below the Lists:

List-I

List-II

(Response to a unit step input)

(Location of poles in the s-plane)



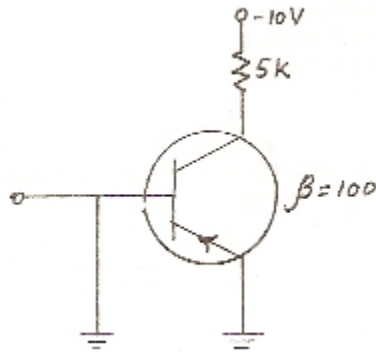
1. One at the origin  
 2. Two identical roots on the negative real axis  
 3. Two on the imaginary axis  
 4. One on the positive real axis

Codes:

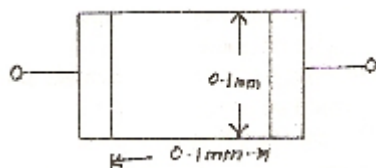
	A	B	C	D
A.	4	3	2	1
B.	3	4	1	2
C.	3	4	2	1

D. 4 3 2 1

36. Dual slope integration type Analog-to-Digital converters provide
- A. higher speeds compared to all other types of A / D converters
  - B. very good accuracy without putting extreme requirements on component stability
  - C. poor rejection of power supply hums
  - D. better resolution compared to all other types of A / D converters for the same number Of bits
37. In the figure given below, the collector current is



- A. 2 mA
  - B. 200 mA
  - C. Almost zero
  - D. 0.02 mA
38. The frequency modulated (FM) radio frequency range is nearly
- A. 250 - 300 MHz
  - B. 150 - 200 MHz
  - C. 90 - 105 MHz
  - D. 30 - 70 MHz
39. A 32 bit microprocessor has the word length equal to
- A. 2 bytes
  - B. 1 byte
  - C. 4 bytes
  - D. 8 bytes
40. In electronic microcircuits, a resistor may be fabricated from constant-thickness layer of semiconductor material with conductor connections at the edges as shown below. If the resistor shown has resistance R, then a similar resistor 0.2 millimeter has a resistance of



- A. 4 R
- B. 2 R
- C. R
- D. R / 2



41. Line imperfection in a crystal is called
  - A. Schottky defect
  - B. Frenkel defect
  - C. edge dislocation
  - D. Miller defect.
42. The function of Diplexer Bridge in a TV transmitter is
  - A. to prevent the loading of several transmitters by video transmitter
  - B. to increase the bandwidth
  - C. to increase the power output
  - D. to increase the efficiency of transmission
43. Sometimes microwave signals follow the earth's curvature. This due to
  - A. Ionospheric reflection
  - B. Faraday rotation
  - C. Ducting
  - D. Ionospheric scatter.
44. The modes in a reflex Klystron
  - A. gives the same frequency but different transit time
  - B. result from excessive transit time across the resonator gap
  - C. are caused by spurious frequency modulation
  - D. are just for theoretical considerations.
45. The capacity of a channel is
  - A. number of digits used in coding
  - B. volume of information it can take
  - C. maximum rate of information transmission
  - D. bandwidth required for information
46. Semiconductor A has a higher band gap than semiconductor B. If both A and B have the same dimensions, the same number of electrons at a given temperature and the same electron and hole mobilities, then
  - A. A has the same number of holes as B
  - B. A has a larger number of holes than B
  - C. A has less number of holes than B
  - D. any of the above statements (a), (b) or (c) could be true
47. Indicate which of the following signals is not transmitted in colour TV
  - A. Y
  - B. Q
  - C. R
  - D. I
48. In one of the following radars, the transmitted beam is steered in angle electronically
  - A. Monopulse Radar
  - B. Pulse compressor Radar
  - C. Phased Array Radar
  - D. Moving Target Indicator.

49. Baretters and bolo meters are used for measurement of  
 A. VSWR  
 B. transmission losses  
 C. microwave power  
 D. none of these
50. DC energy required for satellites is generally derived from  
 A. Solar cells and nickel-cadmium cells  
 B. Solar cells only  
 C. Regulated d.c. poser supplies  
 D. Some special batteries.

### Solution

- 1.A. When two inductors are connected in series, the effective inductance is

$$L_{\text{eff}} = L_1 + L_2 \pm 2 m.$$

$$\begin{aligned} \text{In this case, } L_{\text{eff}} &= L_1 + L_2 - 2 M \\ &= 2 + 4 - 2 \times 0.15 \\ &= 5.7 \text{ mH.} \end{aligned}$$

- 2.C. The plane midway between a and -a, i.e., the one passing through ABC and perpendicular to the plane of the paper is an equipotential plane. Hence the potential at B is the same as that of A or C, i.e., 1V.
- 3.D. In Optocouplers the input signal is applied to the ILED and the output is takes from the phototransistor. These are used to isolate the gate signals from the power circuit.
- 4.C. The difference between the indicated value and the true value of a quantity is known as dynamic error.
- 5.C. The Principles of homogeneity and superposition are applied to linear time invariant systems.
- 6.D. In an 8085 microprocessor system with memory mapped I / O arithmetic and logic operations can be directly performed with I / O data.
- 7.B. Neglecting  $V_{BE}$ ,  $I_B = 10 / 100 = 0.1 \text{ A}$ .  
 $I_C = 100 \times 0.1 = 10 \text{ A}$ . Drop over  $R_L = 10 \text{ v}$ .  
 Hence,  $V_{CE} = 0$  which is the condition for saturation.

8.B. 
$$\eta = \frac{R_r}{R_r + R_d}$$

Where  $R_r$  is radiation resistance and  $R_d$  is the total loss resistance of the antenna.

- 9.B. Arithmetic
- 10.C.  $101.001 = (4 + 0 + 1)$   
 $(0 + 0.25 + 0.125)$   
 $= 5.375$

- 11.B. Dislocations in materials are line defects.
- 12.A. Integrator.
- 13.D. Frequency in the UHF Range propagate by means of space waves.

14.A. VHF.

15.C. a communication satellite is a repeater between many transmitting stations and many receiving stations.

16.C.  $V / \sqrt{2} R$

17.C. The point charge  $Q$  emanates a total electric displacement flux of  $Q$ . If a plane is passed through the point of location of charge and tangential to the sphere, half the flux is on one side and half on the other. The first half of flux is passing through the spherical surface. Thus the average displacement density has a direction opposite to that of  $n$  and the magnitude is

$$\frac{Q/2}{4\pi R^2}$$

$\therefore$  Average electric

Field is:

$$E_{av} = \frac{Q}{3\pi \epsilon R^2} (-n)$$

18.D. The efficiency of a practical chopper varies from 92 to 99 percent.

19.B. Electrostatic voltmeter should be used to measure 600 kV a.c. voltage.

20.A. it can easily be checked that the corresponding function is

$$G(s) = (1 - s) / (1 + s)$$

It is seen immediately that  $|G(j\omega)|$

= 1 and hence gain is db = 0.

21.A. Memory address in hex	Instruction	Remarks
2000	LXI SP 1000	
2003	PUSH H	
2004	PUSH D	We do not
2005	CALL 2025	know the
		Contents of
		Subroutine
		at 2050.
2006	50	
2007	20	
2008	POP H	
2009	HALT	

At the completion of the execution of the program, the program counter of the 8085 contains 2050 and the stack pointer contains OFFC.

22.B. Neglecting,  $V_{BE}$

$$= I_C = \frac{V_{CC}}{R_L + R_B / \beta} = \frac{10}{10 + 1000 / \sqrt{10}} = 0.5 \text{ mA}$$

$$\begin{aligned}
 V_{CE} &= V_{CC} - (I_C + I_B) R_L \\
 &= V_{CC} - I_C R_L \\
 &= 5V
 \end{aligned}$$

$$\begin{aligned}
 \text{or } I_B &= \frac{V_{CC}}{R_B + \beta R_L} \\
 &= \frac{10}{2} = 5mA
 \end{aligned}$$

$$I_C = \beta I_B = 500mA = 0.5A$$

$$\begin{aligned}
 V_{CE} &= V_{CC} - I_C R_L \\
 &= 10 - 0.5 \times 10 = 5V.
 \end{aligned}$$

23.B. Increase =  $10 \log_{10} P_2 / P_1 = 10 \log_{10}^2$   
 $= 10 \times 0.3 = 3dB.$

24.D. Instruction cycle time is exactly the same as the machine cycle time.

25.C. Taking index of  $I = 1$  and  $M = 0$  computing the value of  $M$  with

$$J = 1, 2$$

$$J = 1$$

$$M = 0 + 1 + 1 = 2$$

$$J = 2$$

$$M = 2 + 1 + 2 = 4$$

Taking index of  $I = 2$  and computing the value of  $M$  with  $J = 1, 2$

$$J = 1$$

$$M = 5 + 2 + 1 = 8$$

$$J = 2$$

$$M = 1 + 2 + 2 = 12$$

26.A. Resistivity of electrical conductors is most affected by temperature.

27.B. In CCIR B-system of TV, blanking pulse is placed during retrace interval between each line

28.B. The polarization required in ground wave propagation is vertical (linear).

29.A. Multicavity Klystron is not a good low level amplifier because of noise.

30.D. Transponder comprises of transmitter, receiver and antenna.

31.C. If the switch is closed at instant  $t = t_0$ , the complete expression for current will be

$$\begin{aligned}
 i(t) &= \frac{V}{Z} \sin (wt + \theta - \phi) \\
 &\quad - \sin (wt_0 + \theta - \phi) e^{-R(t-t_0)/L}
 \end{aligned}$$

$$Z = \sqrt{R^2 + L^2 w^2},$$

$$\phi = \tan^{-1} Lw / R$$

The transient component is

$$i_t(t) = -\frac{V}{Z} \sin (wt_0 + \theta - \phi) e^{-R(t-t_0)/L}$$

The transient is zero if  $wt_0 + \theta - \phi = 0$

$$\text{or } t_0 = (\phi - \theta) / w$$

Thus it is possible to find  $t_0$  such that there is no transient. Further  $t_0$  depends upon the circuit parameters and the frequency.

So, the statements 1 and 3 are true.

- 32.A. For points far away, the charge on the ring may be considered to be located at the centre of the ring. Hence, the dipole moment becomes  $Qd$ .
- 33.C. a buck-boost regulator provides an output voltage which may be less than or greater than the input voltage. The output voltage polarity is opposite to that of the input voltage. It has high efficiency.
- 34.A. The deflection of hot wire instrument depends on RMS value of alternating current.
- 35.A. Considering that there are poles of  $H(s)$ , then

$$H_1(s) = \frac{K}{s}, \quad H_2(s) = \frac{K}{(s + \alpha)^2}$$

$$H_3(s) = \frac{K}{(s^2 + w^2)}, \quad H_4(s) = \frac{K}{s - \alpha}$$

The impulse responses  $[\alpha^{-1} H(s)]$  can be found and the step response are integrations of the corresponding impulse responses.

- 36.B. Dual slope integration type A to D converters are of slow speed and require more number of bits, than successive approximation ADC.
- 37.C. Since emitter and base have same polarity and same potential, EBJ is not biased properly. Hence,  $I_B$  is zero and so is  $I_C$ .
- 38.C. The frequency modulated (FM) radio frequency range is nearly 90 - 105 MHz.
- 39.C. 4 bytes.
- 40.C. Resistance will be directly proportional to length and inversely proportional to the cross-sectional area. Let  $t$  mm be the thickness of semi-conductor material so that the cross-sectional area for  $R$  ohm resistor is  $0.1 \times t$  sq. mm and length of semi-conductor material 0.1 mm.

For a  $0.2 \text{ mm} \times 0.2 \text{ mm}$  section, cross-sectional area =  $0.2 \times t$  sq. mm. Length = 0.2 mm

Hence, resistance,

$$= R = \frac{0.1 \times t}{0.2 \times t} \times \frac{0.2}{0.1} = R$$

- 41.C. Line imperfection in a crystal is called edge dislocation.
- 42.A. The function of Diplexer Bridge in a TV transmitter is to prevent the loading of several transmitters by video transmitter.
- 43.C. Sometimes microwave signals follow the earth's curvature. This is due to ducting.
- 44.A. The modes in a reflex Klystron give the same frequency but different transit time.
- 45.C. The capacity of a channel is maximum rate of information transmission
- 46.B. The current density due to electrons in the valence band of a completely filled valence band is

$$J_e = ne (V_e)$$

Where  $n (V_e)$  is the sum of the velocity of all the electrons in this band,  $n$  is the number of electrons per unit volume and  $V_e$  is the average drift velocity of electrons.

The total current density in a semiconductor or an insulator is the sum of the current density due to holes and the current density due to electrons. The electronic current is in a direction opposite to the hole current. The total current density J is obtained by the relation

$$J = J_h + J_e = (p e \mu_h + n e \mu_e)$$

Electrical Conductivity

$$i = 2e \frac{(2\pi kT)^{3/2}}{h^2} (m_e m_h)^{3/4} e^{-E_g/2kT} (\mu_e + \mu_h)$$

For  $(E_g)^3 (E_g)_B$

- 47.C. R signal is not transmitted in colour TV.
- 48.C. In Phased Array Radar, the transmitted beam is steered in angle electronically.
- 49.C. Baretters and bolo meters are used for measurements of microwave power.
- 50.A. DC energy required for satellites is generally derived form solar cells and nickel-cadmium cells.

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