

SAIL Technical Papers Electronics-Engineering MT2010,2011,2012 question papers

1. 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

- A. 5.7 mH
- B. 5.85 mH
- C. 6 mH
- D. 6.15 mH.

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

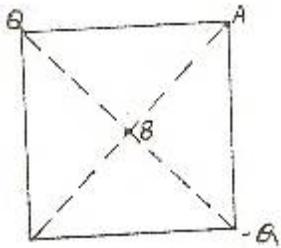
$$L_{\text{eff}} = L_1 + L_2 \pm 2M$$

$$\text{In this case, } L_{\text{eff}} = L_1 + L_2 - 2M$$

$$= 2 + 4 - 2 \times 0.15$$

$$= 5.7 \text{ mH.}$$

2. 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



- 1. zero
- 2.  $\frac{1}{\sqrt{2}} V$
- 3. 1V
- 4.  $\sqrt{2} V$

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. Optocouplers combine

- A. SITs and BJTs
- B. IGBTs and MOSFETS
- C. Power transformers and silicon transistor
- D. Infrared light-emitting diode and a silicon phototransistor

3.D. In optocouplers the input signal is applied to the ILED and the output is taken from the phototransistor. These are used to isolate the gate signals from the power circuit.

4. The difference between the indicated value and the true value of a quantity is known as

- A. Gross error
- B. Absolute error
- C. Dynamic error
- D. Relative error

4.C. The difference between the indicated value and the true value of a quantity is known as dynamic error.

5. The principles of homogeneity and super-position are applied to :

- A. linear time variant systems
- B. non-linear time variant systems
- C. linear time invariant systems
- D. non-linear time invariant systems.

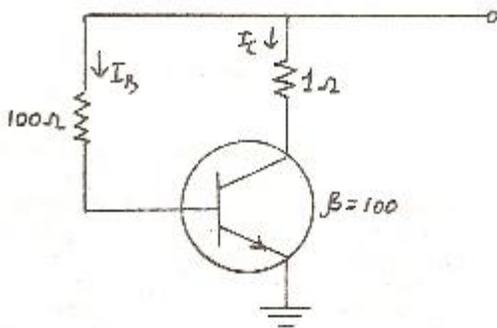
5.C. The Principles of homogeneity and superposition are applied to linear time invariant systems.

6. In a 8085 microprocessor system with memory mapped I / O,

- A. I / O devices have 8-bit addresses
- B. I / O devices are accessed using IN and OUT instructions
- C. 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.

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. The transistor shown in figure below, is biased



- 1. at cut-off
- 2. at saturation
- 3. well into saturation
- 4. well into cut-off

7.B. Neglecting V<sub>BE</sub>, I<sub>B</sub> = 10 / 100 = 0.1 A.  
 I<sub>C</sub> = 100 × 0.1 = 10 A. Drop over R<sub>L</sub> = 10 v.  
 Hence, V<sub>CE</sub> = 0 which is the condition for saturation.

7.B. Neglecting V<sub>BE</sub>, I<sub>B</sub> = 10 / 100 = 0.1 A.  
 I<sub>C</sub> = 100 × 0.1 = 10 A. Drop over R<sub>L</sub> = 10 v.  
 Hence, V<sub>CE</sub> = 0 which is the condition for saturation.

$$\eta = \frac{R_r}{R_r + R_d}$$

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.

8.B. where R<sub>r</sub> is radiation resistance and R<sub>d</sub> is the total loss resistance of the antenna.

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
- 9.B. Arithmetic

10. The binary representation of 5.375 is

- A. 111.1011
- B. 101.1101
- C. 101.011
- D. 111.001

10.C.  $101.001 = (4 + 0 + 1)$   
 $(0 + 0.25 + 0.125)$   
 $= 5.375$

11. Dislocations in materials are

- A. point defect
- B. line defect
- C. planer defect
- D. surface defects.

11.B. Dislocations in materials are line 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.

12.A. Integrator.

13. Frequency in the UHF range propagate by means of

- A. Ground waves
- B. Sky waves
- C. Surface waves
- D. Space waves.

3.D. Frequency in the UHF Range propagate by means of space waves.

14. 200 MHz may be classified as

- A. VHF
- B. SHF
- C. UHF
- D. EHF

14.A. VHF.

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

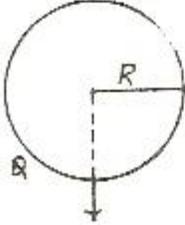
15.C. a communication satellite is a repeater between many transmitting stations and many receiving stations.

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

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



1. infinite

2.  $\frac{Q}{4\pi\epsilon_0} \frac{1}{R^2} (-\vec{n})$

3.  $\frac{Q}{8\pi\epsilon_0} \frac{1}{R^2} (-\vec{n})$

4. Zero

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

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

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

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

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

\ Average electric field is :

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

- 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(jw)|

\ Average electric field is :  
Eav =

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

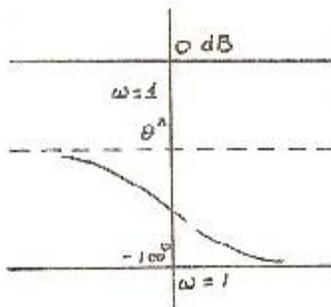
18.D. The efficiency of a practical chopper varies from 92 to 99 percent.

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

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

20.



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

1.  $G = \frac{1-s}{1+s}$

2.  $G = \frac{1}{(1+s)^2}$

3.  $G = \frac{1}{s^2}$

4.  $G = \frac{1}{s(1+s)}$

20

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

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. 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 counter of the 8085 contains ....., and the stack pointer contains .....

2050, OFFC

2251, OFFC

1025, OCCF

1025, OCCF

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

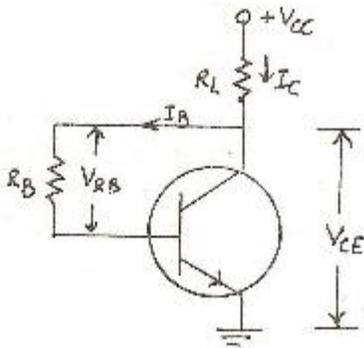
2008 POP H

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. With reference to figure, value of VCE is

22. With reference to figure, value of VCE is



1. 0 V
2. 5 V
3. -5V
4. none of the above

0 V

5 V

-5V

none of the above

22.B. Neglecting, VBE

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

$$= 0.5 \text{ mA}$$

$$V_{CE} = V_{CC} - (I_C + I_B) R_L$$

$$= V_{CC} - I_C R_L$$

$$= 5V$$

$$\text{or } I_B = \frac{V_{CC}}{R_B + \beta R_L}$$

$$= \frac{10}{2} = 5 \text{ mA}$$

$$I_C = \beta I_B = 500 \text{ mA} = 0.5 \text{ A}$$

$$V_{CE} = V_{CC} - I_C R_L$$

$$= 10 - 0.5 \times 10 = 5V.$$

23. The smallest change in sound intensity that can be detected

- A. 1 dB
- B. 3 dB
- C. 10 dB
- D. 20 dB.

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

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

24.D. Instruction cycle time is 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
    
```

- 10
- 11
- 12
- 14

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  $l = 2$  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. Resistivity of electrical conductors is most affected by

- A. temperature
- B. pressure
- C. composition
- D. all of the above.

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

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.

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

28. The polarization required in ground wave propagation is

- A. Horizontal (linear)
- B. vertical (linear)
- C. Circular
- D. Elliptical

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

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

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

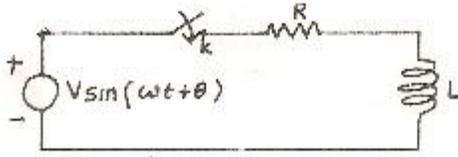
30. Transponder comprises of

- A. Transmitter
- B. Receiver
- C. Antenna
- D. a, b, c combined

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

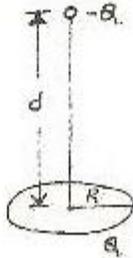
31. Consider the following statements regarding the circuit shown in the given figure :

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 :

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



1.  $Qd$
2.  $Q R^2 / d$
3.  $Q \sqrt{R^2 + d^2}$

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
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Of these statements :

- 1 alone is correct.
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- 1 and 3 are correct
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31.C. If the switch is closed at instant  $t = t_0$ , the complete expression for current will be

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

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

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

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

The transient component is

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

The transient is zero if  $\omega t_0 + \theta - \phi = 0$   
or  $t_0 = (\phi - \theta) / \omega$

Thus it is possible to find  $t_0$  such that there is no transient. Further it 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

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

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

The impulse responses [a-1 H(s)] can be found and the step response are integrations of the corresponding impulse responses

32. A circular ring carrying a uniformly distributed charge  $Q$  and a point charge  $-Q$  on the axis of the ring are shown in the fig. The magnitude of the dipole moment of the charge system is

- Qd
- Q R<sup>2</sup> / d
- Q
- QR.

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. 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

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. 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.

34.A. The deflection of hot wire instrument depends on RMS value of alternating current.

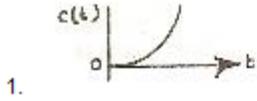
35. Match List-I with List-II and select the correct answer using the codes given below the Lists :

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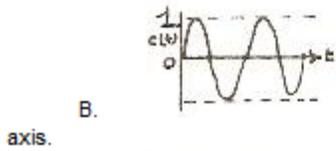
Lists :

List-I  
(Response to a unit step input)

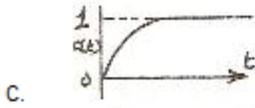
List-II  
(Location of poles in the s-plane)



1. One at the origin



2. Two identical roots on the negative real axis.



3. Two on the imaginary axis



4. One on the position 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

List-I List-II

(Response to a unit step input) (Location of poles in the s-plane)

1. One at the origin

B. 2. Two identical roots on the negative real axis.

C. 3. Two on the imaginary axis

D. 4. One on the position real axis.

Codes:

A B C D

A. 4 3 2 1

B. 3 4 1 2

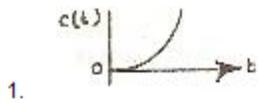
C. 3 4 2 1

D. 4 3 2 1

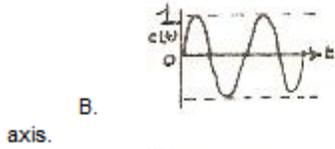
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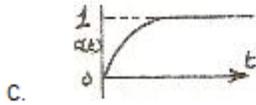
List-II  
(Location of poles in the s-plane)



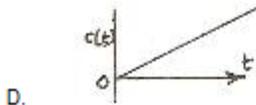
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2. Two identical roots on the negative real axis.



3. Two on the imaginary axis



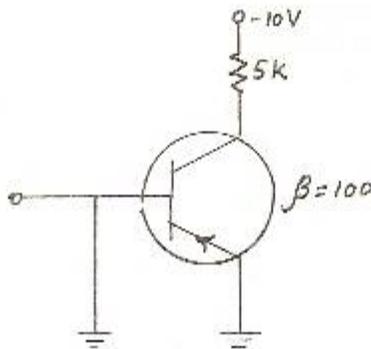
4. One on the positive real axis.

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

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



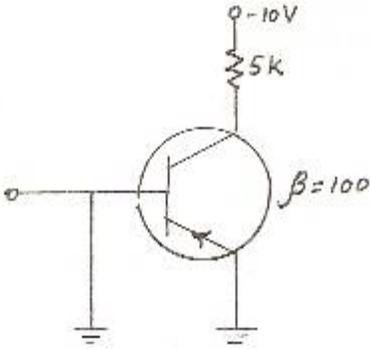
- 2 mA
- 200 mA
- Almost zero
- 0.02 mA

- 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.

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. In the figure given below, the collector current is

37. In the figure given below, the collector current is



- o 2 mA
- o 200 mA
- o Almost zero
- o 0.02 mA

- 2 mA
- 200 mA
- Almost zero
- 0.02 mA

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. 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

38.C. The frequency modulated (FM) radio frequency range is nearly 90 - 105 MHz.

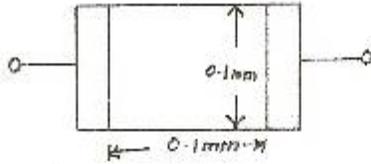
39. A 32 bit microprocessor has the word length equal to

- A. 2 bytes
- B. 1 byte
- C. 4 bytes
- D. 8 bytes

39.C. 4 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

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



- o  $4 R$
- o  $2 R$
- o  $R$
- o  $R / 2$

- 4 R
- 2 R
- R
- R / 2

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,

41. Line imperfection in a crystal is called

- A. Schottky defect
- B. Frenkel defect
- C. edge dislocation
- D. Miller defect.

41.C. Line imperfection in a crystal is called edge dislocation.

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.

42.A. The function of diplexer bridge in a TV transmitter is to prevent the loading of several transmitters by video transmitter.

43. Sometimes microwave signals follow the earth's curvature. This due to

- A. Ionospheric reflection
- B. Faraday rotation
- C. Ducting
- D. Ionospheric scatter.

43.C. Sometimes microwave signals follow the earth's curvature. This is due to ducting.

44. The modes in a reflex Klystron

- A. give 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.

44.A. The modes in a reflex Klystron give the same frequency but different transit time.

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

45.C. The capacity of a channel is maximum rate of information transmission

Fill in the Blanks with appropriate Words

1. 'Please' and 'Thank you' are the little courtesies by which we keep the..... of life oiled and running smoothly.

- (a) river
- (b) garden
- (c) path
- (d) machine-Answer

2. The bright colour of this shirt has..... away.

- (a) gone
- (b) disappeared
- (c) faded-Answer
- (d) paled

3. One major .....between the Election Commission and the Union Government is related to the powers of the former in respect of the deployment of central police forces at places where an election is held.

- (a) conflict-Answer
- (b) pain
- (c) irritant
- (d) culprit

4. Even a .....glance will reveal the mystery

- (a) crude
- (b) cursory-Answer
- (c) critical
- (d) curious

5. His standard of living has..... since his son joined service.

- (a) lifted
- (b) increased
- (c) risen-Answer
- (d) heightened

6. The passengers were afraid but the captain .....them that there was no danger.

- (a) instructed
- (b) advised
- (c) promised
- (d) assured-Answer

7. His first failure did not..... him from making another attempt.

- (a) interfere
- (b) forbid
- (c) frighten
- (d) deter-Answer

8. No one will ..... you for having been rude to your teacher.

- (a) exclaim

(b) admire-Answer

(c) advise

(d) recommend

9. The doctor ..... the patient from taking certain medicines.

(a) banned

(b) prohibited-Answer

(c) prescribed

(d) proscribed

10. I ..... a car to be absolutely necessary these days.

(a) think

(b) regard

(c) consider-Answer

(d) agree

11. He didn't have the ..... idea of villager's problems.

(a) smallest

(b) finest

(c) faintest-Answer

(d) feeblest

12. This is a ..... translation of the speech.

(a) verbatim

(b) verbal

(c) literal-Answer

(d) literary

13. The news of the secret deal soon despite official silence.

(a) discovered

(b) disclosed

(c) leaked out-Answer

(d) divulged

14. No man had a more ..... love for literature, or a higher respect for it, than Samuel Johnson.

(a) arduous

(b) ardent-Answer

(c) animated

(d) adroit

15. I have often ..... why he went to live abroad.

(a) puzzled

(b) wondered-Answer

(c) thought

(d) surprised

16. He lives near ..... a lonely of countryside.

(a) piece

(b) length

(c) stretch-Answer

(d) section

17. To nobody else did the story seem .....

(a) contingent

(b) credible-Answer

(c) credulous

(d) creditable

18. The transfer of territories could not take place because one state ..... the findings

of the Commission.

- (a) objected
- (b) questioned
- (c) rejected
- (d) disputed-Answer

19. Anticipating renewed rioting, the authorities erected .....to block off the streets.

- (a) dykes
- (b) barrages
- (c) barricades-Answer
- (d) barracks

20. When their examinations were over, the children gleefully..... the books they had been reading.

- (a) despised
- (b) neglected-Answer
- (c) shelve
- (d) overthrow