

2021

(CBCS)  
(1<sup>st</sup> Semester)  
**ELECTRONICS**

FIRST PAPER  
**[Electronic Instruments and Circuit Analysis]**

*Full Marks: 75*  
*Time: 2 hours*

**INSTRUCTIONS TO CANDIDATES**

(Please read the instructions carefully before you start writing your answers)

1. Questions should be attempted as per instructions.
2. Do not copy the Questions. Indicate the Section and Question No. clearly while attempting the answer.
3. For Multiple choice answers, candidate should indicate the Question No., Sub. No., (if any) and the correct answer.  
For example :

1. *Name the State capital of Mizoram.*

(a) *Lunglei*

(b) *Aizawl*

(c) *Champhai*

Candidate should provide answer as—Q. No. 1 : *(b) Aizawl*  
[Candidate should avoid writing only *(b)* ]

4. Section B - Answer to Short Answer should be limited to **One Page** only.
5. The figures in the margin indicate full marks for the questions.

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**SECTION : A – OBJECTIVE**

( Marks: 30 )

Choose the correct answer from the following: 1x30=30

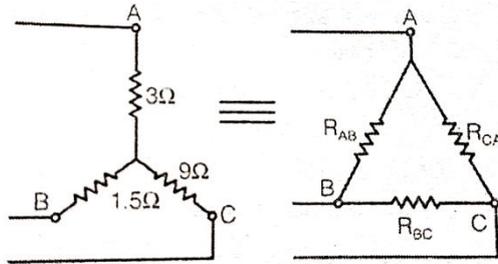
1. Some of the common uses of resistors are:
  - a) to establish proper values of circuit voltages due to IR drops
  - b) to limit current and
  - c) to provide load
  - d) all of above
  
2. For  $27\text{ k}\Omega \pm 10\%$  resistor, the colour code is:
  - a) Red, violet, red and silver
  - b) Red, violet, orange and silver
  - c) Red, violet, yellow and gold
  - d) Red, violet, red and gold
  
3. When connected in series, all capacitors have
  - a) same charge but different voltages.
  - b) same charge and same voltages.
  - c) different charge but same voltages.
  - d) different charge and different voltages
  
4. A capacitor of  $1000\text{ pF}$  is charged to  $100\text{ V}$ . The charge accumulated on the plates of the capacitor is
  - a)  $10^{-7}\text{C}$
  - b)  $6 \times 10^{-2}\text{ C}$
  - c)  $10^{-8}\text{C}$
  - d)  $6 \times 10^{-4}\text{ C}$

5. When the current through an inductor decreases, the amount of energy stored in the electromagnetic field
- increases
  - decreases
  - remains the same
  - doubles
6. How does an inductor work?
- Storing energy as a magnetic field.
  - A wire piece is charged
  - Introducing resistance into a circuit
  - Choking off high-frequency AC
7. An ammeter should have ..... resistance
- High
  - Very high
  - Infinite
  - Very low
8. A galvanometer in series with a high resistance is called .....
- an ammeter
  - a wattmeter
  - a voltmeter
  - all of above
9. The current sensitivity of a multimeter is expressed in
- ampere
  - ohm/ampere
  - ohm/volt
  - ampere/division
10. Time base generator produces a ..... signal used for horizontal deflection of electron beam of a CRO.
- sinusoidal
  - rectangular
  - sawtooth
  - triangular
11. The internal resistance of a VTVM is about .....
- 1000  $\Omega$
  - 10 k $\Omega$
  - 50 k $\Omega$
  - 10 M $\Omega$

12. A VTVM produces very small loading effect on a circuit under test primarily because
- it virtually draws no current from the circuit
  - of its very high internal resistance
  - it uses high vacuum tubes
  - it is a null deflection instrument
13. The power in an ac circuit is given by
- $VI \cos \phi$
  - $VI \sin \phi$
  - $I^2Z$
  - $I^2X_L$
14. In a series R-L-C circuit,  $R = 100 \Omega$ ,  $X_L = 300 \Omega$ , and  $X_C = 200 \Omega$ . The phase angle  $\phi$  of the circuit is \_\_\_\_\_ degrees.
- 0
  - 30
  - 45
  - 60
15. A resonance curve for a series circuit is a plot of frequency verses \_\_\_\_\_.
- voltage
  - impedance
  - current
  - reactance
16. A series circuit becomes resonant when algebraic sum of  $X_L$  and  $X_C$  equals \_\_\_\_\_.
- 2
  - 1
  - 0
  - 1
17. An ac current given by  $i = 14.15 \sin (\omega t - \pi/3)$  has an rms value of \_\_\_\_\_ amperes.
- 10
  - 14.15
  - 1.95
  - 7.07

18. Two sinusoidal currents are given by the equations:  $i_1 = 5 \sin (\omega t + \pi/2)$  and  $i_2 = 10 \sin (\omega t - \pi/3)$ . The phase difference between them is ..... degrees.
- a) 150
  - b) 90
  - c) 60
  - d) 30
19. A linear circuit is one whose parameters (e.g. resistances etc.) .....
- a) change with change in current
  - b) change with change in voltage
  - c) do not change with voltage and current
  - d) none of the above
20. An ideal current source has ..... internal resistance.
- a) infinite
  - b) zero
  - c) small
  - d) none of the above
21. An ideal voltage source has ..... internal resistance.
- a) small
  - b) large
  - c) infinite
  - d) zero
22. Kirchhoff's current law is applicable to only
- a) closed loops in a network
  - b) electronic circuits
  - c) junctions in a network
  - d) electric circuits.
23. The nodal analysis is primarily based on the application of
- a) KVL
  - b) KCL
  - c) Ohm's law
  - d) both (b) and (c)

24. For the given star and delta equivalent circuit shown in the figure, the value of  $R_{AB}$  and  $R_{BC}$  are respectively



- a)  $15 \Omega$  and  $30 \Omega$   
 b)  $5 \Omega$  and  $15 \Omega$   
 c)  $30 \Omega$  and  $5 \Omega$   
 d)  $20 \Omega$  and  $35 \Omega$
25. Superposition theorem can be applied only to circuits having
- a) Resistive elements  
 b) Passive elements  
 c) Nonlinear elements  
 d) Linear bilateral elements
26. The Norton current is sometimes called the .....
- a) shorted-load current  
 b) open-load current  
 c) Thevenin current  
 d) Thevenin voltage
27. The maximum power transfer theorem is used in .....
- a) electronic circuits  
 b) power system  
 c) home lighting circuits  
 d) none of the above
28. Thevenin resistance  $R_{th}$  is found
- a) between any two 'open' terminals  
 b) by short-circuiting the given two terminals  
 c) by removing voltage sources along with their internal resistances  
 d) between same open terminal as for  $V_{th}$

29. "In any linear bilateral network, if a source of e.m.f.  $E$  in any branch produces a current  $I$  in any other branch, then same e.m.f. acting in the second branch would produce the same current  $I$  in the first branch". The above statement is associated with
- a) Reciprocity theorem
  - b) Compensation theorem
  - c) Superposition theorem
  - d) None of the above
30. The Superposition theorem is essentially based on the concept of
- a) duality
  - b) reciprocity
  - c) linearity
  - d) non-linearity

## **SECTION : B – SHORT ANSWER**

(Marks : 45)

***Answer the following questions in not more than 1 (one) page each, choosing 3 (three) questions from each unit.***

3x15=45

### **Unit I**

1. What is a fixed resistor? Describe briefly cermet oxide resistor.
2. Compare air-core, iron-core and ferrite-core inductors
3. What do you mean by voltage rating of the capacitors? Describe the construction of electrolytic capacitors
4. Discuss the factors that controls the capacitance of a capacitor?

### **Unit II**

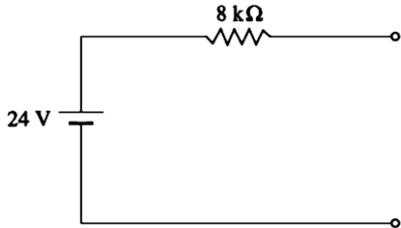
5. How does a multimeter work as an ammeter?
6. Describe the operation of balance bridge type VTVM.
7. Write the function of each block of CRO.
8. Explain the operation of transistor voltmeter circuit.

### **Unit III**

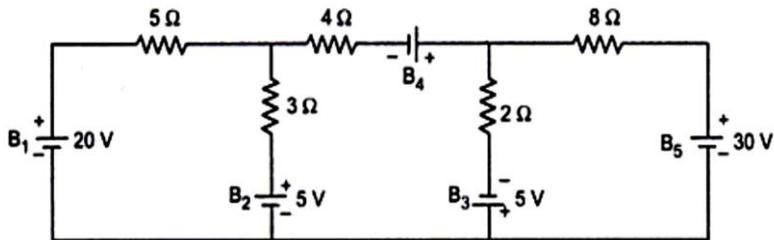
9. Derive the relation between voltage and current in an ac circuit containing resistance R and inductance L in series.
10. Explain briefly the sharpness of resonance circuit
11. Explain how a bandpass filter works?
12. An RLC circuit consists of a capacitor of reactance  $120 \Omega$  and a coil having a resistance  $60 \Omega$  and inductive reactance of  $180 \Omega$ . The combination is connected across a 200 V, 50 Hz source. Compute (i) current, (ii) power factor and power consumed.

## Unit IV

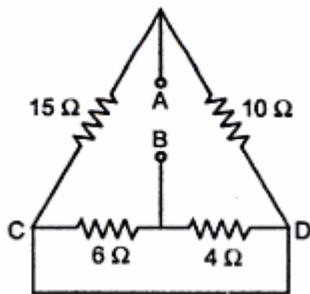
13. Write down various type of sources used in D.C circuits. Convert the voltage source in Fig. into equivalent current source. **(3mA in parallel with 8KΩ)**



14. Explain Kirchoff's law. Determine the current supplied by each battery in the circuit shown in figure by using Kirchoff's law.



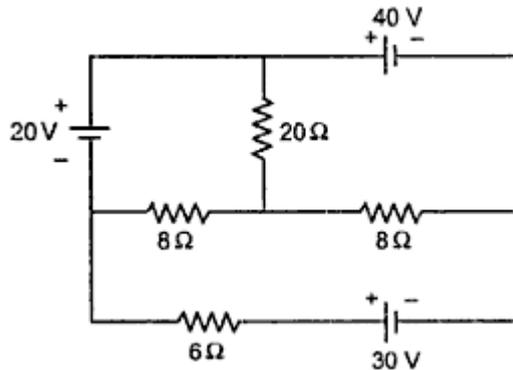
15. Find Equivalent resistance between points A-B from the given figure.



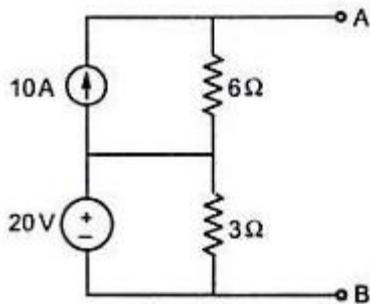
16. Explain the different classification of electrical network.

### Unit V

17. State Superposition theorem and explain it with proper example.
18. Define Thevenin's theorem. For the circuit shown in the figure below, find the current through  $20\ \Omega$  using Thevenin's theorem.



19. Why is maximum power transfer theorem important in electronic circuits? Write down the condition for transfer of maximum power from a source to a load.
20. State and explain Norton's theorem. Replace the given network by Norton's equivalent across the terminal A-B.



\*\*\*\*\* End of question \*\*\*\*\*