2017

(CBCS)

(1st Semester)

ELECTRONICS

Paper : EL – 101

(Electronic Instruments and Circuit Analysis)

Full Marks :75

Time : 3 hours

(PART : A - OBJECTIVE)

(*Marks*:25)

The figures in the margin indicate full marks for the questions

SECTION – A

(*Marks*:l0)

Tick (✓) the correct answer in the brackets provided : 1×10 =10

1. The fifth band of a resistor indicates

   (a) tolerance ( ) (b) resistance value ( )

   (c) reliability ( ) (d) decimal multiplier ( )

2. A capacitor that stores 0.5 C at 10 volts has a capacitance of

   (a) 5 F ( ) (b) 20 F ( )

   (c) 10 F ( ) (d) 0.05 F ( )

3. A galvanometer in parallel with a low resistance is called

   (a) an ammeter ( ) (b) a voltmeter ( )

   (c) a wattmeter ( ) (d) an ohmmeter ( )

4. If alternating current (a.c.) is passed through a permanent-magnet moving coil (PMMC), the driving torque would be

   (a) increased ( ) (b) decreased ( )

   (c) zero ( ) (d) constant ( )

5. The phase difference between voltage and current in the circuit containing a pure resistor is

   (a) 90° ( ) (b) 180° ( )

   (c) 0° ( ) (d) 360° ( )

6. In parallel resonant circuit, at resonance

   (a) current is maximum ( ) (b) current is minimum ( )

   (c) impedance is minimum ( ) (d) current and voltage are in antiphase ( )

7. While applying Kirchhoff's laws to the circuit, assumed direction of current flow must be

   (a) clockwise ( ) (b) from left to right ( )

   (c) anticlockwise ( ) (d) either (a) or (b) ( )

8. An ideal current source is one whose internal impedance is

   (a) very low ( ) (b) zero ( )

   (c) very high ( ) (d) infinity ( )

9. To get the Thevenin's voltage, you have to

   (a) short the load resistor ( ) (b) open the load resistor ( )

   (c) short the voltage source ( ) (d) open the voltage source ( )

10. Maximum power is transferred if load resistance is equal to

    (a) half the internal resistance ( ) (b) internal resistance ( )

    (c) twice the internal resistance ( ) (d) equivalent resistance ( )

SECTION – B

(*Marks*: 15)

Answer the following questions: $3 \times 5 = 15$

1. Define power rating of a resistor. Two carbon-composition resistors of brown, red, brown and yellow, green and black are connected in series. Calculate the combined resistance.

   Or

   Define capacitance of a capacitor. What is the capacitance of a capacitor if a charging current of 100 mA flows when the applied voltage changes 20 V at a frequency of 50 Hz?

2. How do you provide protection for the multimeter in the event of an accidental overload?

   Or

   How can you determine the unknown frequency with the help of a CRO?

3. Briefly explain the sharpness of resonance.

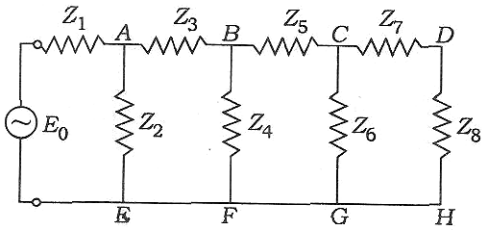
Or

Define phasor and phasor diagram.

4. Derive an expression for voltage division law.

Or

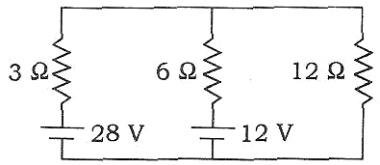
From the following figure, how do you find feeder current and input impedance using ladder network?



5. Explain ideal and practical voltage source.

Or

Using superposition theorem, calculate the current flowing through the 12 12 resistor in the following circuit diagram :



(PART: B - DESCRIPTIVE)
(*Marks*: 50)

The figures in the margin indicate full marks for the questions

1. *(a)* Define capacitor. Describe the preparation, uses and advantages of electrolytic capacitors. 1+4 = 5

(b) What are the two main characteristics of a resistor? Describe briefly the preparation of wire-wound resistor and carbon-composition resistor. 1+2+2=5

Or

(a) What are the factors that control the inductance of an inductor? Two coils each having an inductance of 200 μH. Find the equivalent inductances when the two coils are connected in *(i)* series and *(ii)* parallel that have no mutual inductance. 2+1+1=4

(b) Describe the preparation of paper capacitor and mica capacitor. Two capacitors of 0.0003 μF and 0.0006 μP are connected in series. Find their combined capacitance. If they are connected in parallel, what will be the new value of total capacitance? 2+2+1+1=6

2. *(a)* What are the essentials of an electronic instrument? Explain, with circuit diagram, the working of multimeter as ohmmeter. 3+3=6

(b) With circuit diagram, explain simple VTVM circuit. Explain the application of VTVM for d.c. current measurements. 2+2=4

Or

(a) With a circuit diagram, explain the operation of transistor voltmeter. The emitter follower circuit has V_{CC} = 12 V, R_m = 1 kΩ and a 2 mA meter. If transistor β = 80, then calculate *(i)* the suitable resistance for R_S to give full-scale deflection when E =5 V and *(ii)* the voltmeter input resistance. 3+3=6

(b) Explain, with circuit diagram, the working of multimeter as an ammeter. A multimeter has full-scale deflection current of 1 mA. Determine its sensitivity. 3+1=4

3. *(a)* Derive an expression of alternating current through a series L-C-R circuit. 7

(b) Discuss how a low-pass filter works. 3

Or

(a) What do you mean by *j*-operator? Derive the impedance of an R- C circuit. 2+5=7

(b) Obtain an expression between current and voltage in an alternating circuit consisting of resistance R and inductance L in series. 3

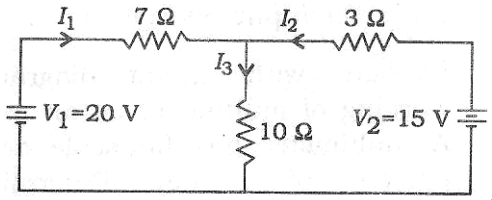
4. *(a)* What is the equivalent current for a voltage source of 6 V in series with 3 Ω resistance? Also draw the diagram. 2

(b) Differentiate between the following: 2+2=4

(i) Linear, and Nonlinear elements

(ii) Unilateral and Bilateral elements

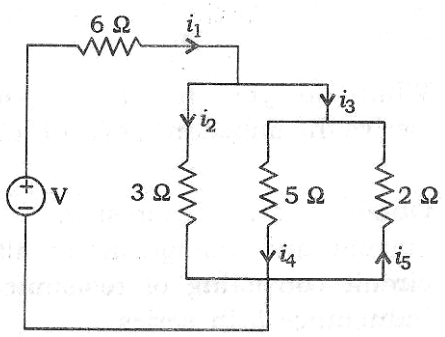
(c) Calculate the voltage and current in the following network using node voltage analysis : 4



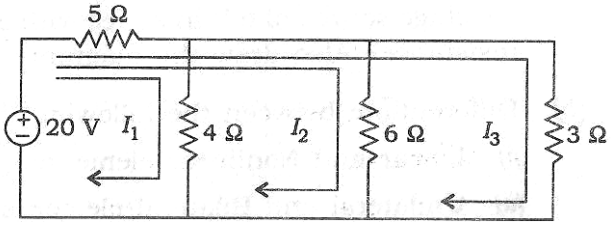
Or

(a) Distinguish between self-resistance and mutual resistance in mesh analysis. 2

(b) For the given circuit, assuming i_1 = 6 A, determine i_2, i_3, i_4 and i_5 : 4

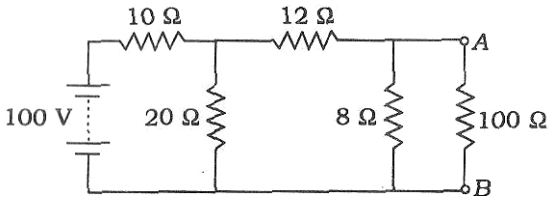


(c) For the given circuit, find I_1, I_2 and I_3, using mesh analysis : 4



5. *(a)* State and prove maximum power transfer theorem. 4

(b) State Thevenin's theorem. Using Thevenin's theorem, find the current through 100 Ω resistance connected across terminals A and B in the circuit given below : 2+4=6

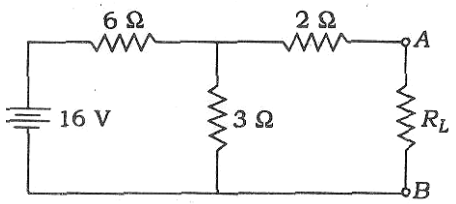


Or

(a) Write the statement and illustration of Norton's theorem. 4

(b) State and prove superposition theorem. 3

(c) In the following circuit, find the value of load resistance RL to be connected across terminals A and B which would abstract maximum power from the circuit. Also find the value of this maximum power : 3



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